AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
	1		3

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
0001	21 MARCH 2002		

6. ISSUED BY	CODE	7. ADMINISTERED BY *(If other than Item 6)*	CODE
US ARMY ENGINEER DISTRICT, FORT WORTH ATTN: CESWF-CT (RM 2A19) PO BOX 17300 FORT WORTH, TX 76102-0300			

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*	(X)	9A. AMENDMENT OF SOLICIATION NO.
	☒	DACA63-02-R-0011
		9B. DATED *(SEE ITEM 11)* 11 MARCH 2002
	☐	10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED *(SEE ITEM 11)*

CODE	FACILITY CODE

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a)By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (*Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

The Request for Proposal for Design-Build Tactical Equipment Shop, Fort Hood, Texas, is amended as follows:

See Continuation Sheet.

NOTE: The Receipt of Proposal date and time remain "9 May 2002, at 4 p.m. local time," as previously announced.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*	16C. DATE SIGNED

Item 14. Continued.

CHANGES TO VOLUME I – PROJECT INFORMATION, BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT

1. Replace the Price Proposal Schedule, (pages 00010-3 through 00010-5), with the accompanying new Price Proposal Schedule, (pages 00010-3 through 00010-5), bearing the notation "ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-02-R-0011."

2. Replace the following Sections with the attached new Sections of the same number and title, bearing the notation “ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-02-R-0011.”

SECTION 00120 PROPOSAL SUBMISSION REQUIREMENTS
SECTION 00150 PROPOSAL EVALUATION AND CONTRACT AWARD

CHANGES TO VOLUME II – DESIGN AND PERFORMANCE REQUIREMENTS

3. Replace the following chapters with the accompanying new chapters of the same number and title, bearing the notation "ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-02-R-0011:"

CHAPTER 111 - FACILITY PERFORMANCE
CHAPTER B22 - EXTERIOR WINDOWS AND OTHER OPENINGS
CHAPTER B23 - EXTERIOR DOORS
CHAPTER B24 - EXTERIOR WALL FIXTURES
CHAPTER C - INTERIORS
CHAPTER C24 - ACCESSORY FIXTURES
CHAPTER D22 - PLUMBING FIXTURES
CHAPTER D3 - HVAC - HEATING, VENTILATING, AND AIR CONDITIONING
CHAPTER D32 - HEAT GENERATION
CHAPTER D6 - ARTIFICIAL LIGHTING
CHAPTER E19 - OTHER EQUIPMENT

4. Delete the following chapter:

CHAPTER D29 - OTHER WATER AND DRAINAGE ELEMENTS

CHANGES TO VOLUME III – SPECIFICATIONS

5. New Sections.- Add the following accompanying new section bearing the notation “ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-02-R-0011 and add the section number and title to the Project Table of Contents:"

SECTION 02746 RESIN MODIFIED PAVEMENT SURFACING MATERIAL

CHANGES TO VOLUME IV – ATTACHMENTS

6. Replace the following Attachment with the accompanying new Attachment of the same number and title, bearing the notation “ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-02-R-0011.”

ATTACHMENT B GEOTECHNICAL REPORT (Includes Appendices A, B and C as issued in original solicitation)

7. Replacement Drawings (Volume IV, Attachment A).- Replace the drawings listed below with the attached new drawings(s) of the same number, bearing the notation "AM #0001":

A02.CAL A-2 Design Analysis
B06.CAL B-6 Door Schedule
C05.CAL C-5 Proposed Site Layout Plan
C06.CAL C-6 Proposed Site Utility Plan
M01.CAL M-1 Plumbing Details
M02.CAL M-2 Plumbing Details

END OF AMENDMENT

Solicitation No.DACA63-02-R-0011

PRICE PROPOSAL SCHEDULE
(To be attached to SF 1442)

Design-Build Tactical Equipment Shop FY02
Fort Hood, Texas

BASE BID: All work required by the Contract documents for the design and construction of the Ft Hood Tactical Equipment Shop exclusive of work required by Option Bid Items.

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0001	All work to design and construct the Tactical Equipment Shop, Complete, Including all **(AM#1)** , utilities to the 1524 mm (5-foot) line, and exclusive of all other work listed separately.	Sum	Job	***	$_____
0002	Construct all Exterior Work outside the building's 1524 mm (5-foot) line (Including utilities to the Fort Hood utility tie-in, earthwork, paving, sidewalk, parking lot paving, curb and gutter, turfing, **(AM#1)** , and all other work not listed separately)	Sum	Job	***	$_____
0003	Final Record Drawings	Sum	Job	***	$ 50,000.00

TOTAL BASE BID $_____

Solicitation No.DACA63-02-R-0011

PRICE PROPOSAL SCHEDULE

0004 OPTION NO. 1:
Additional cost for all work required by the plans and specifications for using epoxy floor covering in lieu of the hardener/sealant used in the Base Bid. (AM#1)

Sum Job *** $_____

TOTAL OPTION NO. 1 $_____

TOTAL BID (BASE BID PLUS OPTION NO. 1) $_____

0005 Completion Time for all work (not to exceed the maximum time stated in Section 01000 DESIGN AND CONSTRUCTION SCHEDULE).

PROJECT COMPLETION TIME: _____ Calendar Days

NOTES:

1. ARITHMETIC DISCREPANCIES (EFARS 14.407-2)

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by bidders:

(1) Obviously misplaced decimal points will be corrected;

(2) In case of discrepancy between unit price and extended price, the unit price will govern;

(3) Apparent errors in extension of unit prices will be corrected; and

(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purpose of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

2. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid

Solicitation No.DACA63-02-R-0011

PRICE PROPOSAL SCHEDULE

NOTES: (cont)

schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the bid schedule.

3. Bidders must bid on all items.

4. Costs attributable to Division 01 - General Requirements is assumed to be prorated among bid items listed.

5. Responders are advised that this project may be delayed, cancelled or revised at any time during the solicitation, selection, evaluation, negotiation and/or final award process based on decisions related to DOD changes in force structure and disposition of the Armed Forces.

6. EXERCISE OF OPTIONS (SWDR 715-1-1 (16 January 1996))

The Government reserves the right to exercise the option(s) by written notice to the Contractor either singularly or in any combination for up to 90 calendar days after award of the Base Bid without an increase in the Offeror's Bid Price. Completion of added items shall continue at the same schedule as the Base Bid unless otherwise noted in Section 01000 DESIGN AND CONSTRUCTION SCHEDULE, paragraph 1 entitled SCHEDULE.

7. The Army will procure this facility through a design and cost competition in accordance with the provisions set forth in this Request for Proposals (RFP). When a contract is awarded, it will be a "Firm Fixed Price Contract."

8. The Congress, in authorizing and funding this contract, has established certain cost limitations for the project. The current authorization for the complete design and construction of this project is **$11,500,000.00**. **(AM#1)** Proposals that exceed this funding limit after exercising any options may be rejected. Submission of desirable alternative features exceeding minimum requirements may be considered as long as award can be made within the established funds.

9. Any proposal that is materially unbalanced as to prices for the Base Schedule may be rejected. An unbalanced proposal is one that is based on prices significantly less than the cost for some work and prices that are significantly overstated for other work and can also exist where only overpricing or underpricing exists.

END OF PRICE PROPOSAL SCHEDULE

SECTION 00120
PROPOSAL SUBMISSION REQUIREMENTS
03/2002

1 GENERAL

1.1 INTRODUCTION

Through the use of a one-step procurement process, the Department of the Army desires to obtain the design and construction of a Tactical Equipment Shop at Fort Hood, Texas. In this procurement procedure consideration will be given to the Project Organization and Personnel; Experience; Past Performance; Financial Capacity; preliminary design, and cost proposals. Final selection and basis for award of the Design/Build Contract will be on the basis of qualifications, technical quality, price, and other salient factors considered to be in the Government's best interests. If awarded the Contract, the offeror shall complete the design and construction documents and construct the facility in compliance with those completed requirements.

1.2 WHERE AND WHEN TO SUBMIT PROPOSAL

Submit the Proposal no later than the date and time indicated in Item 13.A of the Solicitation, Offer and Award form (Standard Form 1442) found in Section 00010, SOLICITATION, OFFER, AND AWARD.

1.3 EXPLANATION TO PROSPECTIVE OFFERORS

Any prospective offeror desiring an explanation or interpretation of the solicitation, drawing, specifications, etc. must request such in writing, and are directed to the individuals listed in Section 00100 INSTRUCTIONS TO OFFERORS, soon enough to allow a reply to reach all prospective offerors before the submission of their proposals. Oral explanation/instructions given before award of a contract will not be binding. Any information given a prospective offeror concerning a solicitation will be furnished promptly to all other prospective offerors as an amendment to the solicitation, if that information is necessary for submitting proposals, or if the lack of it would be prejudicial to other prospective offerors.

1.4 REQUIRED TECHNICAL DATA FOR PROPOSAL SUBMISSION

Offerors are advised that the required data will be utilized for review and evaluation and used for determination of a "Quality Rating" by a Technical Evaluation Board and that all data submitted for consideration under this proposal will be reviewed only for the purposes required for evaluation and award. The Government will not make assumptions concerning the offeror's intent, capabilities, facilities, or experiences. Clear identification is the sole responsibility of the offeror.

1.5 PROPOSAL PREPARATION

Instructions for the preparation and organization of each proposal are included herein. The proposal shall be submitted as summarized below and as required by the specifications.

1.5.1 Volume I – Primary Design Construction Team Management Proposal

A. Project Organization and Personnel
B. Experience
C. Past Performance
D. Financial Capacity

1.5.2 Volume II – Preliminary Design Proposal

A. Design Proposal (Volume II)
B. Preliminary Project Schedule (Volume II)

1.5.3 Volume III – Cost/Price Proposal

A. Solicitation, Offer and Award (SF 1442)
B. Price Proposal Schedule
C. Bid Guarantee
D. Representations and Certifications
E. Subcontracting Plan (Applies to Large Businesses Only)
F. **Small Disadvantaged Business (SDB) Utilization Plan (Applies to all Offerors)**

1.5.4 Format

1.5.4.1 Written Material

a. All written material, including catalog cuts, shall be submitted in standard three ring loose-leaf binders. Proposals shall be tabbed and labeled in a manner to afford easy identification from a Table of Contents. Font size shall be not less than 10 point. Each page shall be identified with the appropriate page number centered at the bottom of the page. Sheet size of the proposal contents shall be 8 ½ by 11 inches. 11 by 17 inch sheets will be allowed for charts and tables but will be counted as 2 single-sided or 4 double-sided pages. Legibility, clarity, coherence, and the contents are important. Volume I (The Primary Design Construction Team Management Proposal) proposal length shall be limited to 70 single-sided or 35 double-sided pages, exclusive of the cover sheet, Table of Contents, and appendices. The offeror shall not submit verbatim sections or attachments of this solicitation as part of their proposal. Offers that do not meet these requirements may be subject to rejection.

b. A cover sheet identifying the offeror and the project shall be provided. The second sheet shall be a Table of Contents.

c. Table of Contents. The proposal shall contain a detailed Table of Contents. The complete Table of Contents shall be included in each binder used.

d. Materials submitted but not required by this solicitation (such as company brochures and equipment lists) shall be relegated to appendices.

e. Proposal revisions for written portions of the proposal, including catalog cuts and specifications, shall be submitted as page replacements with revised text readily identifiable, e.g. bold face print or underlined. The source of the revision, e.g. Error, Omission, or Clarification (EOC), amendment or other Contractor-initiated change, shall also be indicated for each revision. Revised pages shall be numbered, dated, submitted in same number of copies as the original proposal submittal, and a different color page than the original.

1.5.4.2 Drawings

a. Full size drawings shall be submitted in accordance with Section 1016, DESIGN DOCUMENT REQUIREMENTS. Each drawing shall be identified with the appropriate Sequence and Sheet Numbers in the lower right hand corner. The original and one copy of all drawings must be full size drawings. The remaining copies may be full size or reduced size, but no smaller than 11 x 17 inches.

b. All alternate designs which may or may not be priced as additive or deductive items shall be graphically described on separate drawings from the base proposal design. All alternate designs shall meet the minimum requirements of the solicitation.

c. Proposal revisions for drawings shall be submitted as sheet replacements with all changes identified on the drawings with clouds and in the title block, including the source of the revision, e.g. Error, Omission, or Clarification (EOC), amendment, or other Contractor-initiated change. Revised drawings shall be numbered, dated, and submitted in the same number of copies as the original proposal submittal.

1.5.4.3 Electronic Material

The offeror shall submit one copy of the proposal and all revisions, if applicable, on CD-ROM. All textual material, catalog cuts, and other non-drawing material shall be in Adobe Acrobat Portable Document Format (.pdf), arranged in the same order as the hard copy version with each section or part book marked. All drawings shall be formatted in accordance with Section 1016 DESIGN DOCUMENT REQUIREMENTS, Paragraph ".CAL Files." The offeror must ensure that all textual material, if it has been scanned, has been converted to a text searchable document by using the Paper Capture tool in Adobe Acrobat.

1.5.4.4 Proposal Submission

The proposal submitted shall include an original, copies as indicated below, and one electronic copy on CD-ROM disks (Volumes I and II on one disk and Volume III on another disk.) Each proposal shall be marked to clearly identify the original and the copies. The copies shall be numbered.

Volume I – Primary Design Construction Team Management Proposal	Original and nine (9) copies
Volume II – Preliminary Design Proposal	Original and nine (9) copies
Volume III – Cost/Price Proposal	Original and nine (9) copies

1.6 REFERENCED PUBLICATIONS

Corps of Engineers' (COE) design criteria and manuals that are referenced in this solicitation, such as Technical Manuals (TM) and Instructions (TI), Military Handbooks, Engineering Regulations (ER), and Engineering Manuals (EM), can be downloaded from the Internet at the following address: http://www.hnd.usace.army.mil/techinfo or obtained from the current National Institute of Building Science's (NIB) Construction Criteria Base (CCB) CD-ROM disk. The COE SWD-AEIM, AR 190-51, and EC 1110-1-92 are on the Solicitation CD-ROM Disk. The Installation Information Infrastructure Architecture (I3A) guidelines can be downloaded from the Internet at the following address: http://arch-odisc4.army.mil/. Obtaining other referenced publications such as Federal and Military specifications, Military Standards, and industry standards (i.e., ASTM, ANSI, ACI, NFPA, building codes) will be the responsibility of each offeror. See Section 00100 INSTRUCTIONS TO OFFERORS, paragraph "52.211-2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) AND DESCRIPTIONS LISTED IN THE ACQUISITION MANAGEMENT SYSTEMS AND DATA REQUIREMENTS CONTROL LIST, DOD 5010.12-L (AUG 1998)", for information on obtaining these publications. Offerors are warned that due to the limited time for proposal preparation and submittal, there may not be enough time for ordering and receiving any of the above references. Failure to receive requested references will not be sufficient reason for extension of the proposal submission date.

1.7 UNNECESSARILY ELABORATE PROPOSALS OR QUOTATIONS

Unnecessarily elaborate brochures or other presentations beyond those sufficient to present a complete and effective response to this solicitation are not desired and may be construed as an indication of the offeror's lack of cost consciousness. Elaborate artwork, expensive paper and bindings, and expensive visual and other presentation aids are neither necessary nor wanted.

1.8 REQUIREMENT FOR SPECIAL MARKING OF PROPOSAL DATA

Envelopes or other cover for material submitted in response to this RFP shall be opaque, and must be so presented that they may easily be identified. At a minimum, the outside cover for each volime must show:

Destination of Proposal
Name and location of project as described in the RFP documents
Solicitation number
Name and address of offeror
Project volume number

Submit the proposal in the format specified. Oral or telephonic proposals or modifications will not be considered.

Mail or deliver the proposal to the address listed on the Standard Form 1442, "Solicitation, Offer and Award."

1.9 DESCRIPTION OF EVALUATION CRITERIA

1.9.1 **Volume I – Primary Design Construction Team Management Proposal Preparation**

The Primary Design Construction Team Management Proposal shall include information as described below and shall be presented in the sequence listed.

A. Project Organization and Personnel:

1. Personnel (Primary Design Construction Team):

a. This factor considers the offeror's proposed design, construction, and management team. Provide professional resume data on the individuals who will be key personnel on the Primary Design Construction project team. Key personnel identified in this section should besenior working-level people who will be involved in design and construction on a day-to-day basis, as opposed to departmental level supervisors or executives. If reassignment of personnel is considered possible, provide the names and resumes of the alternate professionals in each assignment.

See Sections 01015 DESIGN REQUIREMENTS AFTER AWARD, 01320 PROJECT SCHEDULE, 01430 DESIGN QUALITY CONTROL, and 01451 CONTRACTOR QUALITY CONTROL for minimum personnel qualifications. The following list shall be provided as a minimum:

Project Manager
Project Architect
Senior Structural Engineer
Senior Mechanical Engineer
Senior Electrical Engineer
Senior Civil Engineer
Fire Protection Engineer
Corrosion Engineer or Specialist (NACE)
Registered Communication Distribution Designer
Design Quality Control Manager
Construction Quality Control Manager
Project Scheduler

Information to be provided includes:

Name
Project assignment
Name of firm with which associated
Years experience: with this firm, with other firms
Education: degrees(s)/year/specialization
Active registration: state and year first registered

Experience and qualifications relevant to proposed project: for each project listed, provide project description, project dates, the individual's project assignment to include specific roles and responsibilities, and its relevance to this solicitation. Identify the length of time key personnel stayed on their contracts and how well they managed their portion of the referenced contracts.

b. Identify the Designer(s)-of-Record for each discipline

c. In an appendix, provide letters of commitment for all key personnel on the Primary Design Construction project team and any proposed alternate personnel. By identifying these personnel, the offeror is making a commitment that, barring unforeseen circumstances, they are the personnel who will be assigned to the project. A letter of commitment from each firm committing specific individuals from the firm may be provided in lieu of separate letters for each individual. After contract award, substitutions for any of the key personnel or alternates shall require the Contracting Officer's approval.

d. Capacity to Perform

(1) Provide a list of key professional job titles. Indicate the total number of personnel in each category for the Primary Design Construction Team, including consultants, and identify all personnel.

(2) Discuss capacity to successfully perform the requirements of this Contract based on current workload and staffing. Discuss strategy to provide supplemental and/or replacement personnel to support this project during design and/or construction, as necessary. In the appendix, provide a list of all current contracts for the Primary Design Construction Team members, including consultants.

2. Team Organization and Management:

a. Provide an organizational chart and supporting narrative describing how the team will be structured. Include all key design and construction personnel and firms on the organizational chart. Discuss the specific roles and responsibilities of each key individual and firm.

b. Describe the proposed management structure for the team. Discuss how the design and construction process will be managed, to include a discussion on delegation of authority within the team.

c. Describe interactions within the team and with the Corps of Engineers during design. Discuss how design changes will be handled and the roles that various team members will play when dealing with design changes. Discuss the role of construction team members during design phase.

d. Describe interactions within the team and with the Corps of Engineers during construction. Discuss how changes will be handled during construction and the roles that various team members will play when dealing with changes during construction. Discuss the role of design team members during construction. Specifically address design team's role in construction Quality Control program; Requests For Information (RFI's); shop drawing/submittal review and approval; attending progress meetings; site visits; inspections; and contract completion and closeout.

e. Describe the time control systems to be utilized. Discuss the use of the project schedule for managing the design and construction. Describe internal procedures for handling delays to minimize time growth.

f. Identify the items of work to be self-performed by offeror and the percentage of the overall contract value that this work represents.

g. Describe the team's computer-aided drafting and design (CADD) capabilities. Identify the CADD software to be used in the design of this project; if all disciplines are not using the same CADD software, identify the software that each discipline is using. Discuss compatibility with the Government's target CADD. Explain how compatibility will be achieved if the design, or portion of the design, is prepared using a CADD system other than the Government's target CADD system. (Refer to Section 01016 DESIGN DOCUMENT REQUIREMENTS for information on the Government's target CADD system and compatibility requirements.)

B. Experience

1. Provide a list of projects currently underway or completed within the last 5 years that best demonstrates the design and construction experience of the team (firms and/or individual team members) to successfully complete this facility using a design/build process. Experience beyond 5 years ago for construction contractors will not be given consideration unless the key personnel proposed for this project played a significant role in the earlier project and the project can be shown to be similar to this project. An offeror must make clear the extent of involvement in those projects by current key personnel and clearly describe how the older project is similar to this project, considering changes in technology, materials, equipment, codes, etc. Experience beyond 5 years ago for design firms will not be given consideration.

List no more than 10 projects total. The list of projects shall include the following information:

a. Project name and location
b. Type of facility
c. Nature of firm's responsibility (design, construction or both)
d. Identify type of contract (design, design/build, or construction)
e. Project owner's name and address and project manager's (point of contact) name, telephone number, fax number, and email address (if known)
f. If a government contract, include the contracting agency and contracting officer's name, telephone number, fax number, and email address (if known)
g. Date started
h. Original scheduled completion date
i. Actual completion date
j. Overall size of facility (in square feet or square meters)
k. Construction cost (excluding design costs)
l. Duration of construction (excluding design time)
m. Problems encountered and corrective actions taken
n. Identify which proposed team members and/or firms were involved in the project; their specific roles and responsibilities on the project; and the extent of time they were involved with the project
o. Relevance of experience to the solicitation project

2. Joint Ventures: If offeror represents the combining of two or more companies for the purpose of this RFP, the proposal shall indicate whether the firms have experience working together in design/build ventures and for how long and how many projects. In addition, each company of this joint venture shall list their Government contract experiences.

C. Past Performance:

1. For each design and/or construction firm on the project team, provide firm’s name, address, and DUNS number.

2. Non-Corps References

For each non-Corps project listed under "Volume I: Experience" factor, offerors should send Client Authorization Letters and Contractor Performance Report (See Section 00500) to each reference listed in the proposal to assist in the timely processing of the past performance evaluation. In an appendix, provide a copy of issued letters with the offeror's proposal. Copies of aforementioned letters will not count towards the page limitation stated in Paragraph 1.5.4.1 of this Section.

3. Offerors are encouraged to submit awards, letters, evaluations, or other forms of recognition that demonstrate their performance capabilities and customer satisfaction. If provided, this additional past performance information shall be relegated to an appendix and will not count towards the aforementioned page limitation.

4. New Companies

For new companies entering the marketplace (without relevant company experience) the quality of the past performance of their key management personnel of the Primary Design Construction Team and and consultants will indicate the risk of good performance and become the basis of the past performance evaluation. Identifying how long key personnel stayed on their contracts and how well they managed their portion of the referenced contracts will be of great importance in the evaluation process.

D. Financial Capacity:

Submit a letter of current bonding capacity from a Bonding Company. This letter will not count towards the aforementioned page limitation.

1.9.2 Volume II – Design Proposal Preparation

PRELIMINARY DESIGN PROPOSAL

The purpose of the Preliminary Design Proposal is:

To provide sufficient design information for the Government to determine the acceptability of the proposed design in meeting the functional requirements set forth herein for operational use and economical maintenance during the anticipated life of the facility.

To provide data for a determination of the engineering sufficiency and soundness of the basic approach to the design for each technical discipline. Also, it will serve as a documentary check that the designer has been provided or has developed the essential engineering criteria necessary for all facets of final computations and detailed development of a thoroughly engineered, coordinated, economical, and functional design.

The Preliminary Design Proposal consists of two parts, the Design Proposal and the Preliminary Project Schedule:

A. Design Proposal

1. The design proposal shall include, as a minimum, the following descriptive narratives, manufacturer's catalog data, and graphic information:

a. Narratives

(1) General Description

(a) Provide brief description of the facility addressing the overall design, materials components, and engineering. DO NOT INCLUDE DESIGN CALCULATIONS. Include the following:

(i) Basic site layout and the rationale behind the site design. Address existing site features, site demolition requirements, new utilities, site improvements**, and identify pavement section to be used for hardstand pavement. (am#1)**
(ii) Building's architectural configuration and the rationale behind the design. Address relationship of the site and site activities to the building. Address exterior and interior building materials.
(iii) Building's interior configuration, to include general discussion on interior finishes, including those in the shops, offices, general administrative areas, warehouse and common areas (copy rooms, break/vending areas, restrooms). Discuss use of common areas within the facility. DO NOT PROVIDE COLOR BOARDS.

.

(iv) Structural system and the rationale behind the selection of the proposed system, including identification of major structural materials and systems.
(v) Heating, Ventilation and Air Conditioning system and rationale behind the selection of the proposed system.
(vi) Vehicle Maintenance Systems including waste oil, waste antifreeze, off-spec fuel collection and storage, POL distribution and dispensing systems, vehicle exhaust systems, parts wash and wash bay systems, compressed air systems and rationale behind the selection of the proposed systems.
(vii) Hoisting systems and the rationale behind the selection of the proposed systems.
(viii) Fire protection system and the rationale behind the selection of the proposed system.
(ix) Exterior power distribution systems (upgrade to existing system) and the rationale behind the selection of the proposed system. Discuss service to the building and location. Identify type of wire. Identify whether aerial or underground.
(x) Interior power distribution systems and the rationale behind the selection of the proposed system. Identify electrical characteristics of power supply (phase, voltage, KVA). Provide description of panels, protection devices and typical loading of circuits. Identify type of wire.
(xi) Exterior lighting system and the rationale behind the proposed system. Address exterior lighting locations, illumination levels for each area, and lighting controls.
(xii) Interior lighting system and the rationale behind the selection of the proposed system. Address illumination levels for each area, emergency lighting, and lighting controls.
(xiii) Interior communications systems (telephone, data, cable TV, sound transmission) and the rationale behind the selection of each system.
(xiv) Environmental Considerations and Occupational Safety and Health Issues.

(b) Describe the energy-efficient and/or energy-saving features proposed for this project.

(c) Identification of proposed methods of meeting security requirements.

(d) **If the design proposal includes any deviations from the RFP requirements, including functional or adjacency requirements, identify the deviation, provide justification for the deviation, and describe the benefit/improvement that the deviation provides to the facility.** (See Section 00150 PROPOSAL EVALUATION AND CONTRACT AWARD, paragraph "DESIGN FREEDOM".)

(e) **Identify all proposed betterments.** (See Section 00800 SPECIAL CONTRACT PROCEDURES, clauses entitled "DESIGN-BUILD CONTRACT ORDER OF PRECEDENCE" AND "PROPOSED BETTERMENTS".)

b. Manufacturer Catalog Data

Manufacturer catalog data shall include industry standard quality indicators for the specific material or equipment and that will be used to establish the proposed construction quality during proposal evaluation. Data may be in the form of CSI standard product information formats Manu-Spec and Spec-Data, and manufacturer's specifications and details. Furnish data, arranged by CSI Divisions, on:

(1) Glazing: windows and glazing for library and classrooms.
(2) Doors
(3) Interior finishes, to include floors, base, walls, ceilings, toilet partitions, lavatory tops
(4) Exterior finishes, to include walls, roof, and soffits
(5) Interior and exterior light fixtures, including identification of where each proposed fixture type will be used
(6) Any other catalog data deemed pertinent

c. Graphic Information

Furnish preliminary drawings and schematics to illustrate the proposal. If a plan does not fit on one standard size drawing sheet at the scale specified, provide an overall plan to fit on one standard size drawing sheet plus individual sheets at the scale specified.

(1) Site Layout Plan, minimum scale 1:400 or 1:500, showing:
  (a) Building location
  (b) Service drives, parking, and hardstand
  (c) Location of site features (i.e. landscaping, sidewalks, lighting, mechanical and electrical equipment)
  (d) Set-backs
  (e) Preliminary grading and drainage Plan

(2) Architectural Floor Plans, minimum scale 1:100 (1/8" = 1'), with all areas identified, showing:
  (a) Gross area of building; exterior and interior dimensions; size of areas; critical and basic dimensions.
  (b) Area calculations
  (c) Preliminary finish schedule
  (d) Plumbing fixture locations, including drinking fountains
  (e) Furniture layout (Note: Providing furniture is not a part of the Contract)

(3) Interior Sections/Elevations, minimum scale 1:50 (1/4" = 1'), showing:
  (a) Offices
  (b) Common areas (break/vending areas, copy areas)
  (c) Restrooms
  (d) Shops
  (e) Warehouse

(4) Exterior Elevations of building(s), minimum scale 1:100 (1/8" = 1'), showing:
  (a) Fenestrations and material indications.
  (b) Critical and basic dimensions.
  (c) Exterior finish materials.

(5) Building Cross-Sections

Provide one cross-section through each wing of the building(s)and one longitudinal cross-section through the building indicating floor and ceiling heights, and all overhead equipment and utility distribution as well as crane hook range of motion.

d. Sustainable Design. Using the Sustainable Project Rating Tool (SPiRiT), provide a self-assessment of the sustainability features of the facility (see Volume IV ATTACHMENTS for the Sustainable Project Rating Tool manual and rating sheets). For each required element and for each point-scored element where you have met (or exceeded) the requirement, provide justification of how you have met the stated requirement. Justification shall be documented on the non-annotated version of SPiRiT tool (SPiRiT v1.4 (.doc). April 2001) available on the Internet at http://www.cecer.army.mil/Sustdesign/SPiRiT.cfm, or use the version that is on the Solicitation CD. Justification shall be inserted in the document immediately after the requirement text for each element. Label the justification as "Justification of Scoring". Scoring shall be summarized on the SPiRiT scoring sheet (SpiRiT v1.4 (.xls), April 2001) available at http://www.cecer.army.mil/Sustdesign/SPiRiT.cfm (this file is also located on the Solicitation CD). This scoring summary shall be attached to the front of the SPiRiT tool in the submitted documentation. Goal is minimum Bronze level certification. If Bronze level certification cannot be attained, discuss the factors that prevent achieving this goal in one section prior to the beginning of the SPiRiT scoring summary.

B. Preliminary Project Schedule.

A time-scaled logic diagram shall be submitted with the Preliminary Design proposal reflecting the detailed design phase activities and summary level construction activities from Notice to Proceed through final completion, including all option work. Project Schedule shall conform to Section 01320 PROJECT SCHEDULE and may be used for preparation of the Preliminary Schedule required in Section 01320 after award. The following information shall be included as a minimum:

1. Detailed design activities
2. Summary level construction activities
3. Phasing requirements
4. Critical Path
5. Milestones and Constraints
6. Overall Design Duration, in calendar days
7. Overall Construction Duration, in calendar days
8. Overall Proposed Duration, in calendar days

The Contractor shall propose the contract durations for Work Item #1, Design and Construction of the new facility. The proposed duration shall not exceed the duration specified in Section 01000, Design and Construction Schedule. The proposed schedule shall support the proposed duration. Upon contract award, the successful offeror's proposed duration shall become the contract duration for Work Item #1. It should be noted that the Government will include provisions in the contract for liquidated damages for each calendar day the Contractor exceeds the contract schedule.

1.9.3 VOLUME III Cost/Price Proposal Preparation

Prices shall be firm. The offeror's price, to be considered in the competitive negotiation evaluation, shall be the offeror's Total Base Bid, including all option work, as shown on the price proposal schedule. The cost/price proposal will be evaluated separately, after evaluation of Volume I and Volume II. The cost/price proposal shall consist of the following:

1. Solicitation, Offer and Award.

The Standard Form 1442 shall be completely filled out and signed by a principal of the firm authorized to bind the design-build team. Signature(s) must be in long hand.

2. Price Proposal Schedule

a. Offerors shall complete the Price Proposal Schedule by filling out the pricing data blanks.

b. Overhead and profit shall be applied proportionally to each category and will not be required to be shown separately.

c. Offerors shall include allowance for weather days in the Cost/Price Proposal and shall schedule any contingency for severe weather in accordance with weather requirements included in Section 01000, DESIGN AND CONSTRUCTION SCHEDULE.

3. Bid Guarantee.

The bid guarantee shall be submitted in accordance with Section 00700, Contract Clauses.

4. Representations and Certifications.

Representations are local, state, and federal representative statements and certifications made by the Offeror concerning a variety of issues. Complete each item in Section 00600, REPRESENTATIONS AND CERTIFICATIONS, and submit one original with the Volume III proposal.

5. Subcontracting Plan. (Applies to Large Businesses only.)

All large businesses shall submit a subcontracting plan with their technical and price/cost proposals. The plan shall be prepared in accordance with FAR 52.219-9. Failure to submit an acceptable subcontracting plan may make the offeror ineligible for award of the contract. The submission of the subcontracting plan is in no way advantageous to large businesses over any small business in the evaluation process. A sample subcontracting plan and scoring checklist are included on the solicitation CD-ROM disk. See Section 00100 INSTRUCTIONS TO OFFERORS, paragraph SMALL BUSINESS SUBCONTRACTING PLAN for additional information and Fort Worth District subcontracting floors.

6. Small Disadvantaged Business (SDB) Utilization Plan. (Applies to all Offerors.)

Offerors shall submit a SDB Utilization Plan, to include the following information:

a. Identification of each SDB concern proposed and the work each is to perform.

b. Targets expressed in dollars and percentages representing each SDB concern's participation of the total contract value.

c. Total target value of all SDB participation, expressed in dollars and percentages, of the total contract value.

The offeror is put on notice that any targets represented in submitted proposal will be incorporated into and become part of any resulting contract. All proposed SDB concerns must be certified by the Small Business Administration and listed in the online database PRO-Net. SDB concerns may register in PRO-Net at http://pronet.sba.gov.

1.10 CLARIFICATIONS AND FINAL PROPOSAL REVISION

1.10.1 General

Any conflicting criteria which cannot be resolved by the Order of Precedence specified in Section 00800 SPECIAL CONTRACT REQUIREMENTS shall be brought to the attention of the Government by the Offeror as part of the written clarification requirement of the proposal. In the absence of such request for clarification, the Offeror shall perform to the most beneficial criteria as determined by the Government.

1.10.2 Clarifications Prior to Proposal Due Date

In the event that clarifications are required prior to submitting the Volume I or II proposal, contact the individuals listed in Section 00100, INSTRUCTIONS TO OFFERORS. All RFP holders will be advised of significant clarifications affecting the scope of the project.

1.10.3 Clarifications Submitted with Proposals

For clarifications remaining at the time and date that proposals are due, written clarifications may be included in the proposal for consideration by the Government. Clarifications submitted with proposals shall clearly identify the understanding of the RFP documents and how this understanding is reflected in the cost proposal. Extensive qualifications, exclusions and exceptions in the form of clarifications may be considered by the Government to be non-responsive and may be grounds for rejection of the proposal.

1.10.4 Final Proposal Revision

If the Contracting Officer determines that discussions are necessary, all offerors in the competitive range will be given an opportunity to submit a final proposal revision. All proposal revisions must be submitted as required in paragraph 1.5.4 Format, subparagraphs 1.5.4.1 Written Material and 1.5.4.2 Drawings.

1.11 PAYMENT FOR PROPOSALS

Offerors will not be reimbursed for the cost of preparing their proposals.

1.12 NOTICE

Failure to submit all the data indicated in this section may be cause for determining a proposal non-responsive and, therefore, not considered for award.

2 PRODUCTS (NOT USED)

3 EXECUTION (NOT USED)

END OF SECTION

SECTION 00150
PROPOSAL EVALUATION AND CONTRACT AWARD
03/2002

1 GENERAL

1.1 PROPOSAL EVALUTION

Proposals will be evaluated by a Technical Evaluation Board (TEB). The TEB will be made up of Corps of Engineers and Fort Hood personnel. Board members will not be available for contact or discussion prior to submission of proposals.

1.2 EVALUATION CRITERIA

1.2.1 Volume I Criteria

The Primary Design Construction Team Management proposal evaluation criteria below corresponds to the outline specified in Section 00120 PROPOSAL SUBMISSION REQUIREMENTS, paragraph 1.9.1 Primary Design Construction Team Management Proposal Preparation. Factor A, B and C are of equal importance and will be given a quality rating. Sub-factors within each factor are of equal importance, unless identified otherwise. Those offerors with no relevant performance history will be assigned a neutral rating in past performance factor. Factor D will be rated "go" or "no go."

Volume I – Primary Design Construction Team Management Proposal

A. Project Organization and Personnel

1. Personnel (Prime and Subcontractor).

The TEB will evaluate the adequacy, strengths and weakness of key personnel assignments, to include compliance with registration and/or other specified minimum qualification requirements; qualifications and experience relevant to the proposed project; familiarity with local conditions; and familiarity with applicable building codes and standards.

The TEB will verify that the Designer of Record has been identified for each design discipline and that letters of commitment have been provided for all key personnel on the project team.

The TEB will evaluate the personnel resources assigned to the project and the ability to provide additional resources for the team if supplemental or replacement personnel are required. Consideration will be based on degree of coverage by discipline for all aspects of design and construction' depth of additional resources to supplement the planned resources, if necessary; whether same-discipline depth is from the same firm/office as the key personnel in that discipline or from a different firm or office.

2. Team Organization and Management

The TEB will evaluate the team structure, the strength of the team organization and the responsibilities for each key individual and firm on the team.

The TEB will evaluate the management structure, delegation of authority, and offeror's approach to managing the design-build process. The TEB will assess the offeror's ability to coordinate the design and construction personnel in a team effort, as evidenced by the offeror's approach to managing the design-build team, delegation of authority, and team interaction and communication during design and construction.

The TEB will assess the offeror's approach to managing and controlling time during design and construction. Consideration will be given to the scheduling system to be used and compatibility of the offeror's scheduling system with the Government's scheduling system (Primavera, Version 3.1). The offeror's use of the schedule in managing the project will be evaluated.

The TEB will evaluate the work to be self-performed by the offeror (percentage and type). Additional consideration will be given to those offerors that exceed the minimum requirements for work to be self-performed, as identified in the contract clause entitled "Performance of the Work by the Contractor."

The TEB will evaluate the compatibility of proposed CADD system with Government system. Additional consideration will be given for designs prepared in the Government's target CADD system. The amount of consideration will depend on the extent to which the target CADD system is used by the various design disciplines in preparing the design.

B. Experience

1. The offeror will be evaluated based on the recent experiences of the team (firms and/or individual team members). The amount of consideration will depend upon the extent of the offeror's experience, similarity between previous project scopes of work and this project, and the relevance of the offeror's experience to this project. Experience in the following areas will be considered, in decreasing order of importance:

a. Design-build experience. No previous design-build team experience is necessary to qualify for award of this project; however, consideration will be given for recent, successful D-B team experience between the prime construction firm and design firms(s).

b. Experience with vehicle maintenance facilities of similar size and scope. Design, construction, and/or design-build experience are all considered relevant.

c. Sustainable design experience.

d. Previous experience as a team. Extent to which members of the proposed team have worked together on previous projects as a team will be considered. Design team experience, construction team experience and design-construction team experience are all considered relevant.

e. Experience with Corps of Engineers or other federal contracts. Familiarity with federal regulations and administration of Corps of Engineers or other federal contracts are considered relevant.

f. Experience with design and/or construction at Fort Hood or in the local vicinity. Familiarity with Fort Hood installation requirements and the local vicinity is considered relevant.

C. Past Performance

1. Past performance of the offeror, subcontractors, consultants, and key individuals will be considered in evaluating past performance, utilizing information provided in the proposal and other information available to the Contracting Officer, including but not limited to the following: The following will be considered in descending order of importance:

a. CCASS (Construction Contract Administration Support System) Evaluations. CCASS evaluations will be utilized to evaluate past performance on Corps of Engineers contracts for construction firms on the offeror's Design-Build team.

ACASS (A-E Contract Administration Support System) Evaluations. ACASS evaluations will be utilized in evaluating the past performance on Corps of Engineers contracts for Architect-Engineering firms on the offeror's Design-Build team.

b. Federal Agency Performance Evaluations
c. Contractor Performance Report From State and local governments and private sector clients. Submitted Contractor Performance Reports may be verified telephonically. References not supported by a Contractor Performance Report may be contacted in writing or telephonically to assess customer satisfaction.
d. Awards, letters, and other forms of recognition
e. All other information

D. Financial Capacity

The TEB will verify that a letter of current bonding capacity has been provided and that the offeror has sufficient bonding capacity for this project. A current Dun and Bradstreet profile will be reviewed to verify that the offeror's financial standing is satisfactory.

1.2.2 Volumes II & III Criteria

The evaluation criteria below correspond to the outline specified in Section 00120 PROPOSAL SUBMISSION REQUIREMENTS, paragraph 1.9.2 Volume II – Design Proposal Preparation and 1.9.3 Volume III Cost/Price Proposal Preparation. Factor A is significantly more important than Factor B. The sub-factors are listed in decreasing order of importance. Unless noted otherwise, elements within each sub-factor are listed in decreasing order of importance. All sub-factors with in Factor C (Volume III) will be rated "go" or "no-go," with the exception of cost/price, which will not be rated.

Volume II – Preliminary Design Proposal

A. Design Proposal

1. Soundness and quality of design
   a. Functional aspects of facility
   b. Durability of materials
   c. Design rationale
   d. Compatibility of design and materials with Fort Hood Installation Design Guide

2. Comfort, aesthetics and amenities
   a. deleted (am#1)
   b. Environmental Considerations and Occupational Safety and Health Issues
   c. Site features and site layout
   d. Vehicle Maintenance System (am#1)
   e. Energy-efficient and/or energy-saving features
   f. HVAC system
   g. Aesthetics of the facility (interior and exterior)
   h. Facility enhancements

3. Sustainable Design (Sustainable Project Rating Tool - SPiRiT criteria):

Goal is to achieve SPiRiT Bronze level certification. Additional consideration will be given for achievement of higher SPiRiT levels. See Volume 4, Attachment J, of the solicitation for the SPiRiT manual and rating sheets or the Internet web page at http://www.cecer.army.mil/Sustdesign/SPiRiT.cfm.

B. Preliminary Project Schedule

The schedule will be evaluated to assess the offeror's understanding of the design-build process, project scope, phasing requirements, milestones and constraints, and critical elements in design and construction. The design and construction periods offered, the proposed contract durations, and the overall project schedule will be evaluated for realism and for benefits they provide to the Government.

Volume III – Cost/Price Proposal

C. Cost/Price Proposal

1. Standard Form 1442

2. Price proposal schedule, Section 00010

3. Bid Guarantee

4. Representation & Certifications, Section 00600

5. Subcontracting Plan (large businesses only)

The subcontracting plan will be reviewed for compliance and scored in accordance with Army Federal Acquisition Regulation Supplement (AFARS) Appendix CC. Failure to submit an acceptable subcontracting plan may make the offeror ineligible for award of the contract.

6. Small Disadvantaged Business Utilization (SDB) Plan. The SDB utilization plan will be reviewed based on the following criteria:

a. The extent to which SDB concerns are specifically identified.

b. The extent of commitment to use SDB concerns.

c. The complexity and variety of the work SDB concerns are to perform.

d. The extent of participation of SDB concerns in terms of the value of the total acquisition.

1.3 DESIGN FREEDOM

REQUIREMENTS STATED IN THIS RFP ARE MINIMUM REQUIREMENTS. Innovative, creative, or cost-saving proposals that meet or exceed these requirements are encouraged and will receive consideration accordingly. Deviations from space and adjacency requirements are discouraged unless the change results in a significant improvement to the facility. Deviations from any requirements should be clearly noted and justified in the proposal. Informative drawing notes are encouraged.

1.4 METHOD OF PROPOSAL EVALUATION

1.4.1 Government's Rights and Goals

The Government reserves the right to reject any or all proposals at any time prior to award; to award a contract to other than the offeror submitting the lowest priced offer; and to award a contract to the offeror submitting the proposal determined to be the most advantageous to the Government. It is the Government's goal to award the project within its construction cost limitation. Significant variation from this amount could result in the Government's inability to award based on lack of funding authority.

1.4.2 Evaluation Process

All proposals will be reviewed to determine if the minimum data and technical requirements have been met. A proposal may be determined to be unacceptable and therefore eliminated if all the required information is not provided or if the proposal materially deviates from the requirements of the RFP.

Weighing of evaluation criteria will take into consideration not only how important a particular element is to the overall project, but also the innovative, creative, or cost-saving elements which may be incorporated into the proposal (see paragraph "DESIGN FREEDOM") and are advantageous to the Government.

1.4.3 Basis of Award

The Government intends to award a contract without discussions based on initial proposals received; therefore, the offerors proposal should contain the offeror's best terms from a cost and technical standpoint. However, the government reserves the right to conduct discussions in accordance with FAR 52.215-1. . Should discussion be necessary after evaluations, the Government will establish a competitive range of the offerors that are the most highly rated. The Government reserves the right to address any pertinent issues in the proposals.

An award will be made to the offeror whose offer contains the combination of the criteria offering the best overall proposal to the Government based on consideration of technical merit, cost, and other pertinent factors as specified in the RFP. Volume I – Primary Design Construction Team Management proposal is considered more important than Volume II, Preliminary Design Proposal, and will carry more weight in the overall rating of the proposals. The combined Primary Design Construction Team Management and Preliminary Design proposal rating is significantly more important than Volume III - Cost/Price.

END OF SECTION

CHAPTER 111

FACILITY PERFORMANCE

PERFORMANCE

A. Basic Function:

1. Provide built elements and site modifications as required to fulfill needs described in the project program.

2. The complete project comprises the following elements:
   a. Substructure (A): Elements below grade and in contact with the ground.
   b. Shell (B): The superstructure, exterior enclosure, and the roofing.
   c. Interiors (C): Interior construction, stairs, finishes, and fixtures, except fixtures associated with services and specialized equipment.
   d. Services (D): Mechanized, artificial, automatic, and unattended means of supply, distribution, transport, removal, disposal, protection, control, and communication.
   e. Equipment and Furnishings (E): Fixed and movable elements operated or used by occupants in the functioning of the project.
   f. Sitework (G): Modifications to the site, site improvements, and utilities.

3. Code: Make all portions of the project comply with the code. The code referred to herein consists of all applicable local, State, and federal regulations, including those listed below:
   a. Federal Regulatory Requirements:
      1) For Environmental Design, see addtional federal regulation references in Chapter XII ENVIRONMENTAL DESIGN of SWD-AEIM (item H), Volume IV ATTACHMENTS.
      2) 29 CFR 1910-1997, Occupational Safety and Health Standards, and in particular 29 CFR 1910.1001, Appendix F, "Work Practices and Engineering Controls for Automotive Brake and Clutch Inspection, Disassembly and Assembly."
      3) MIL-HDBK-1008C (10 June 1997) Fire Protection For Facilities Engineering, Design and Construction
      4) U.S. Environmental Protection Agency (EPA), National Pollution Discharge Elimination System (NPDES) Storm Water Construction Permit in accordance with Federal register, Volume 63, Number 128, July 6, 1998.
   b. State of Texas regulatory requirements, Texas Natural Resource Conservation Commission (TNRCC).
      1) Air emission in accordance with 30 Texas Administrative Code (TAC) 116.111 and 30 TAC 106
      2) Underground and Aboveground Storage Tanks per 30 TAC 334
      3) Erosion and sedimentation control regulations, see NPDES requirements above and section 01421 OUTLINE OF A BASIC STORM WATER POLLUTION PREVENTION PLAN, Volume III SPECIFICATIONS.
   c. Non-Regulatory Criteria Documents: In addition to specific regulatory requirements, the following documents are also incorporated into the definition of "the code" for the purposes of this project, except for administrative provisions contained therein; where referenced, the role of the code official described in the document will be performed by Government.
      1) NFPA 70-2002, National Electrical Code.
      2) NFPA 101-2000, Safety to Life From Fire in Buildings and Structures.
      3) ICC International Fire Code, 2000 edition.
      4) ICC International Building Code, 2000 edition.
      5) ICC International Plumbing Code, 2000 edition.
      6) ICC International Mechanical Code, 2000 edition.
      7) ICC International Fuel Gas Code, 2000 edition.
      8) Army Regulation (AR) 200-1, Environmental Protection and Enhancement, February 1997.

9) Additional non-regulatory references from Army and Corps of Engineers as stated in Chapter XII ENVIRONMENTAL DESIGN of SWD-AEIM (item H), Volume IV ATTACHMENTS.
10) SWD Architectural and Engineering Instructions Manual (SWD-AEIM), October 2000.

4. Environmentally Responsible Design: In addition to other requirements, provide design and construction that minimizes adverse effects on the exterior environment, enhances the quality of the indoor environment, and minimizes consumption of energy, water, construction materials, and other resources.
   a. Achieve at least a Bronze rating in accordance with Sustainable Project Rating Tool (SPiRiT) which is derived from The U. S. Green Building Council LEED 2.0 (Leadership in Energy and Environmental Design) Green Building Rating System; selection of specific credits to achieve is the responsibility of Contractor unless otherwise indicated; comply with criteria specified in current Sustainable Project Rating Tool (SPiRiT) documentation as well as related criteria specified in other chapters.
   b. Water Conservation:
      1) Reduction of potable water use for sewage conveyance:.
      2) Reduction of water used by plumbing fixtures, appliances, and equipment, in excess of regulatory requirements: Desirable.
   c. Substantiation:
      1) Proposal Stage: SPiRiT Checklist annotated to show specific credits to be achieved with brief description of how they will be achieved. See Sections 00120 PROPOSAL SUBMISSION REQUIREMENTS and 00150 EVALUATION FACTORS FOR AWARD.
      2) Design Development and Construction Documents Stages: SPiRiT Checklist annotated to show status of design related to specific credits to be achieved and a comprehensive checklist of certification document specified in SPiRiT Reference Guide annotated to show status of preparation of documentation.

5. In addition to the requirements of this chapter, comply with requirements of Chapter 1 - Program Summary, Chapter 11 - Program, and Chapter 00830 - Design and Construction Procedures.

B. Amenity and Comfort:

1. Thermal Performance: Design and construct to provide comfortable interior environment in accordance with the code and the following:
   a. Summer Interior Design Conditions (Air Conditioned Core Areas):
      1) Daytime Setpoint: 25 deg C (78 deg F), plus or minus 1 deg C (2 deg F).
      2) Night Setback: 32 deg C (90 deg F).
      3) Interior Relative Humidity: 50 percent, maximum.
   b. Summer Interior Design Conditions (Maintenance Bays and Warehouse):
      1) No comfort conditioning required. Natural ventilation through open bay doors and general mechanical ventilation for indoor air quality only will be provided.
   c. Winter Interior Design Conditions (Core Areas):
      1) Daytime Setpoint: 22 deg C (72 deg F), plus or minus 1 deg C (2 deg F).
      2) Interior Relative Humidity: 30 percent, minimum.
   d. Winter Interior Design Conditions (Maintenance Bays and Warehouse):
      1) Daytime Setpoint: 13 deg C (55 deg F), plus or minus 1 deg C (2 deg F).
      2) Night Setback: 7 deg C (45 deg F).
   e. Outside Air Design Conditions:
      1) Summer Outside Air Design Temperature: 0.4 percent cooling design condition listed in the 1997 ASHRAE Fundamentals Handbook.
      2) Winter Outside Air Design Temperature: 99.6 percent heating design condition listed in the 1997 ASHRAE Fundamentals Handbook.
   f. Energy Design Wind Speed: 40 km/h (25 mph).

C. Health and Safety:

1. Fire Resistance: Provide Type II-B construction in accordance with ICC International Code.

2. Prevention of Accidental Injury: As required by code and as follows:
   a. Safety Glazing: As defined by 16 CFR 1201; provide in locations required by code.
   b. Other requirements specified in other Chapters.
   c. Substantiation:
      1) Preliminary Design: Identification of building elements that require special accident prevention measures.
      2) Design Development: Identification of safety measures taken, detailed description of design criteria, and structural analysis of load-resisting elements prepared by licensed structural engineer.
      3) Construction Documents: For load-resisting elements, structural design calculations and drawings sealed by licensed structural engineer.

3. Lightning Hazard: Design to prevent damage to occupants, structure, services, and contents due to lightning strikes if a lightning protection risk analysis produces a "moderate" or higher risk.
   a. Provide protection equivalent to that specified in NFPA 780-1997; supplementary strike termination devices, ground conductors, and grounding electrodes are required only where the integral portions of the structure cannot perform those functions.
   b. Ground Resistance Measurement Methods: As described in IEEE 81-1983.
   c. Substantiation:
      1) Commissioning: Continuity tests for grounding conductors, equipotential bonding of other systems, and ground terminals; ground resistance test for each ground terminal, or equivalent taking into account related grounding systems.

4. Health Hazards:
   a. Design to prevent growth of fungus, mold, and bacteria on surfaces and in concealed spaces.
   b. Hazardous Construction Materials: Design and construct to comply with the requirements of the code and the following:
   c. Indoor Air Quality: Design and construct to comply with the code and the following:
      1) Acceptable air quality as defined by ANSI/ASHRAE 62-1999.
      2) Substantiation:
         a) Design Development: Identification of methods to be used to comply with requirements; ventilation design calculations. Identification of unusual indoor contaminants or sources and methods to mitigate their effects on occupants.
         b) Construction Documents: Specifications showing that construction materials are not contaminant sources and do not adversely affect air quality.
         c) Commissioning: Field measured outside and supply air quantities for each air handler.
         d) Occupancy: Field testing to show compliance, after full occupancy.

5. Physical Security: In addition to any provisions that may be required by law or code, design and construct both exterior and interior spaces to incorporate accepted principles of crime prevention through environmental design (CPTED), using natural (as opposed to technological) methods of providing surveillance, access control, and territorial reinforcement wherever possible.
   a. Definition of Elements at Ground Level: For purposes of physical security, any element within 6 m (20 feet) of the ground, grade, or adjacent paving.
   b. Security Zones:
      1) Public Access Zone: That area to which the public has free access, including public corridors, grounds, and parking lots.
      2) Reception Zone: The area to which the general public has access but beyond which access is restricted at all times.
      3) Operations Zone: The area to which only employees, staff, or authorized personnel have access.

4) Secure Zone: The area to which access is always controlled and which is monitored continuously.
5) High-Security Zone: Areas indicated in project program and areas named "vault", "secure file room", and "cash room".

c. See other Chapters for additional requirements.

6. Electrically-Operated Equipment and Appliances: UL listed for application or purpose to which they are put; suitable for wet locations listing for exterior use.

7. Explosion Hazards: The following hazards will exist in the building:
a. External Hazards: offspec fuel storage and waste oil storage.
b. Internal Hazards: maintenance inspection pit.

D. Structure:

1. Earthquake Loads: Accommodate Maximum Considered Earthquake Ground Motion (MCE) of 0.2 s Spectral Response Acceleration (5% of Critical Damping), Ss, of 0.09 g, and Maximum Considered Earthquake Ground Motion (MCE) of 1.0 s Spectral Response Acceleration (5% of Critical Damping), S1, of 0.05 g, and Soil Profile Type D; and otherwise in compliance with ANSI/ASCE 7-1998.

2. Substantiation:
a. Preliminary Design: Detailed listing of design criteria and preliminary analysis, prepared by a licensed structural engineer.
b. Construction Documents: Detailed design analysis by licensed structural engineer.

E. Durability:

1. Expected Service Life Span: Expected functional service life of the built portions of this project is 50 years.
a. Service life spans of individual elements that differ from the overall project life span are defined in other Chapters.
b. Additional requirements for elements not required to have life span equal to that of the project as a whole are specified below under "Operation and Maintenance."
c. Substantiation: Since actual service life cannot be proven, substantiation of actual service life is not required; however, the following are reasonable indicators of anticipatable service life:
1) Design Development: Service life expectancy analysis, for each element for which life span is specified; including:
a) Length of effective service life, and aesthetic service life if specified, with action required at end; e.g. complete replacement, partial replacement, refurbishment.
b) Basis of time estimates; e.g. proven-in-use application.
c) Basis of confidence in time estimates; e.g. similarity of present application to proven-in-use application.
d) Conditions under which estimate will be valid; e.g. expected uses, inspection frequency, maintenance frequency, etc.
2) Design Development: Replacement cost, in today's dollars, for each major element that has a service life expectancy less than that of the project; include both material and labor cost, but not overhead or profit; base costs on installing in existing building, not as a new installation.
3) Design Development: Life cycle cost of project, over the specified project service life, excluding operating staff costs; include costs of:
a) Replacement of each element not expected to last the life of the project; identify the frequency of replacement.
b) Energy for operation of equipment and systems, from energy analysis specified under "Operation and Maintenance".
c) Routine maintenance of operating equipment, including replacement of worn parts

before failure; identify frequency of maintenance.
d) Routine cleaning of exposed materials; identify type of cleaning and frequency.
e) Deduct salvage value of replaced elements.
f) Calculate costs in today's dollars, disregarding the time value of money, inflation, taxes, and insurance.

2. Animals: Do not use materials that are attractive to or edible by animals or birds.

3. Insects: Do not use materials that are edible by insects, unless access by insects is prevented.

F. Operation and Maintenance:

1. Energy Efficiency: Minimize energy consumption while providing function, amenity, and comfort specified.
   a. Provide energy efficient design using procedures and values specified in ASHRAE 90.1-1999.
      1) Provide at least 10 percent less energy consumption than that of an equivalent minimally-complying baseline building, demonstrated by comparing the actual Design Energy Cost to the Energy Cost Budget of a prototype building, both calculated in accordance with ASHRAE 90.1.
   b. Substantiation:
      1) Design Development: Detailed listing of design criteria and design analysis showing compliance, prepared by a licensed mechanical engineer.
      2) Design Development: Energy cost of all energy-consuming equipment and systems over the first year of operation; include analysis of probable change in annual cost over time due to aging but disregarding inflation and rate changes.
      3) Construction Documents: Detailed listing of design criteria and design analysis showing compliance, prepared by a licensed mechanical engineer.

2. Water Consumption: Minimize water consumption.
   a. Substantiation:
      1) Design Development: Quantity of water that will be used in the first year of operation, divided into domestic water, HVAC water, and other water categories, with required storage capacity and quantity of water recycled, if any; include basis of calculations.
      2) Construction Documents: Updated water consumption, based on actual equipment selections and sizes.

3. Waste (Trash/Rubbish) Removal: As described in the project program and as follows:
   a. See Chapter E11 for requirements for solid waste disposal.
   b. .**Not used (am#1)**

4. Ease of Operation: Provide facility, equipment, and systems that are easily operated by personnel with a reasonable level of training for similar activities.
   a. Minimize the need for specialized training in operation of specific equipment or systems; identify all equipment and systems for which the manufacturer recommends or provides training programs.
   b. Train Government's personnel in operation of equipment and systems; see Chapter 00830 for additional requirements.
   c. Substantiation:
      1) Design Development: Operating impact analysis, including identification of type and quantity of staff, tools, and supplies required; estimate of impact that aging materials will have on operating requirements; no cost calculations required; identify source of data.
      2) Construction Documents: Updated operating impact analysis, based on actual product selections.

5. Ease of Maintenance: Minimize the amount of maintenance required.

a. Substantiation:
   1) Design Development: Maintenance impact analysis, including identification of maintenance effort (type of staff, time required, and frequency), tools, and supplies required, over expected functional and aesthetic service life of project; including preventive maintenance, replacement of parts, and cleaning, but not energy for operation or replacement at end of service life; no cost calculations required; identify source of data.
   2) Design Development: Maintenance cost for first year of operation, based on use of maintenance contracts; estimate of the impact that aging materials will have on maintenance costs; description of maintenance activities included in estimated cost.
   3) Construction Documents: Updated maintenance impact analysis, based on final product selections.
   4) Construction Documents: Updated maintenance cost for first year of operation, based on actual product selections.

6. Ease of Repair: Elements that do not meet the specified requirements for ease of repair may be used, provided they meet the specified requirements for ease of replacement of elements not required to have service life span equal to that specified for the project as a whole; the service life expectancy analysis and life cycle cost substantiation specified for service life are provided; and Government' acceptance is granted.

7. Ease of Replacement:
   a. Elements Not Required to have the Expected Service Life Span Equal to that Specified for the Project as a Whole: Make provisions for replacement without undue disruption of building operation.

ELEMENTS AND PRODUCTS

A. In addition to requirements specified in other chapters, provide products and elements that comply with the following.

B. Elements Made Up of More Than One Product:

1. Where an element is specified by performance criteria, use construction either proven-in-use or proven-by-mock-up, unless otherwise indicated.
   a. Proven-In-Use: Proven to comply by having actually been built to the same or very similar design with the same materials as proposed and functioning as specified.
   b. Proven-by-Mock-Up: Compliance reasonably predictable by having been tested in full-scale mock-up using the same materials and design as proposed and functioning as specified. Testing need not have been accomplished specifically for this project; when published listings of independent agencies include details of testing and results, citation of test by listing number is sufficient (submittal of all test details is not required).
   c. The Contractor may choose whether to use elements proven-in-use or proven-by-mock-up, unless either option is indicated as specifically required.
   d. Where test methods accompany performance requirements, use those test methods to test the mock-up.
   e. Exception: Where a design analysis is specified, or allowed by the Government, substantiation of proven-in-use or proven-by-mock up construction is not required.

2. Where a type of product is specified, without performance criteria specifically applicable to the element, use the type of product specified.

3. Where more than one type of product is specified, without performance criteria specifically applicable to the element, use one of the types of products specified.

4. Where a type of product is specified, with applicable performance criteria, use either the type of product specified or another type of product that meets the performance criteria as

proven-in-use or proven-by-mock-up.

5. Where more than one type of product is specified, with applicable performance criteria, use either one of the types of products specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.

6. Where neither types of products nor performance criteria are specified, use products that will perform well within the specified life span of the building.

C. Products:

1. Where a product is specified only by a manufacturer name and model number/brand name, use only that model/brand product.

2. Where the properties of a product are specified by description and/or with performance criteria, use products that comply with the description and/or performance criteria.

3. Where manufacturers are listed for a particular product, use a product made by one of those manufacturers that also complies with other requirements.

4. Builders' Hardware:
   a. All hardware, including hinges, closers, locksets, exit devices, door hold open devices, and door stops, shall be grade 1 in accordance with the Builders Hardware Manufacturers Association ANSI/BHMA Standards.
   b. Lock Trim: Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA A156.13, knobs, lever handles, roses, and escutcheons shall be 0.050 inch (1.27mm) thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch (0.89 mm) thick and the combined thickness shall be 0.070 inch (1.78 mm) except that knob shanks shall be 0.060 inch (1.52 mm) thick. Knob diameter shall be 2-1/8 to 2-1/4 inches (54 to 57 mm). Lever handles shall be of plain design with ends returned to no more than 1/2 inch (10 mm) from the door face.
   c. Lock Cylinders and Cores (Mortise, Rim and Bored)
      1) Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have not less than seven pins.
      2) Cylinders shall have key removable type cores.
         a) Disassembly of knob or lockset shall not be required to remove core from lockset.
         b) All locksets, lockable exit devices, and padlocks shall accept the same interchangeable cores.
      3) Provide a master keying system.
      4) Provide a construction master keying system .
         a) Furnish with construction interchangeable cores.
         b) Use the manufacturer's standard construction key system.
      5) Keying: Locks shall be keyed in sets or subsets. Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." The keys shall be furnished to the Contracting Officer arranged in a container in sets or subsets as scheduled.
      6) Keys shall be supplied as follows:
         a) Locks: 3 change keys each lock.
         b) Master keyed sets: 6 keys each set.
         c) Control keys: 6 total.
         d) Construction keys: 6 total.
         e) Blank keys: 20 total.

SUBSTANTIATION

A. Definition: Substantiation is any form of evidence that is used to predict whether the design will comply with the requirements or to verify that the construction based on the design actually does

comply. During Design Development and Construction Documents, requirements to submit substantiation are primarily intended to forestall use of designs or constructions that will not comply. At any time before completion of construction, substantiation is presumed to be only a prediction and may subsequently be invalidated by actual results.

1. Regardless of whether substantiation is specified or not, the actual construction must comply with the specified requirements and may, at the Government's discretion, be examined, inspected, or tested to determine compliance.

2. Substantiation submittals will not be approved or accepted, except to the extent that they are part of documents required to be approved or accepted in order to proceed to the next stage of design or construction. However, approval or acceptance of substantiation will not constitute approval or acceptance of deviations from the specified requirements unless those deviations are specifically identified as such on the submittal. See Division 1 Sections 01015 DESIGN REQUIREMENTS AFTER AWARD and 01330 CONSTRUCTION SUBMITTAL PROCEDURES for definitions of "approved" and "accepted" submittals.

3. The Government accepts the responsibility to review substantiation submittals in a timely manner and to respond if they are unacceptable.

B. In addition to the requirements stated in other chapters, provide the following substantiation of compliance at each stage of the project:

1. If a substantiation requirement is specified without an indication of when it is to be submitted, submit or execute it before the end of Construction Documents.

2. See also Division 1 Sections 01015 DESIGN REQUIREMENTS AFTER AWARD and 01330 CONSTRUCTION SUBMITTAL PROCEDURES for submittal requirements.

C. Previous Construction: Where elements proven-in-use are used to comply with performance requirements:

1. In the Proposal, identify which elements will be accomplished using proven-in-use elements.

2. During Design Development, identify proven-in-use elements proposed for use, including building name, location, date of construction, owner contact, and description of design and materials in sufficient detail to enable reproduction in this project.

D. Mock-Up Testing: Where elements proven-by-mock-up are used to comply with performance requirements:

1. In the Proposal, identify which elements will be accomplished using proven-by-mock-up elements.

2. During Design Development, identify proven-by-mock-up elements proposed for use, with test report including date and location of test, name of testing agency, and description of test and mock-up.

3. Mock-up testing need not have been performed specifically for this project, provided the mock-up is substantially similar in design and construction to the element proposed.

E. Design Analyses (including Engineering Calculations):

1. Where a design analysis or calculation is specified without identifying a particular method, perform analysis in accordance with accepted engineering or scientific principles to show compliance with specified requirements, and submit report that includes analysis methods used and the name and qualifications of the designer.

2. Where engineering design is allowed to be completed after commencement of construction, substantiation may be in the form of shop drawings or other data.

3. Submit design analyses at the end of Design Development unless otherwise indicated.

4. Where design analysis is specified to be performed by licensed design professional, use a design professional licensed in the State in which the Project is located.

F. Products:

1. Where actual brand name products are not identified by either the Government or the Contractor, identify the products to be used.

2. During Design Development:
   a. Where more than one product type is identified for a particular system, assembly, or element, identify exactly which type will be used.
   b. For each product type, provide descriptive or performance specifications; early submittals may be brief specifications, but complete specifications are required prior to completion of construction documents.
   c. For each product type, identify at least one manufacturer that will be used.
   d. For major manufactured products that are commonly purchased by brand name, and any other products so indicated, provide manufacturer's product literature on at least one actual brand name product that meets the specifications, including performance data and sample warranty.

3. During Construction:
   a. Identify actual brand name products used for every product, except commodity products specified by performance or description.
   b. Where a product is specified by performance requirements with test methods, and if so specified, provide test reports showing compliance.
   c. Provide manufacturer's product literature for each brand name product.
   d. Provide the manufacturer's certification that the product used on the project complies with the contract documents.
   e. Builders' Hardware:
      1) **Hardware and Accessories**: Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data for locksets, exit devices, closers, electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices, after approval of the detail drawings, and not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.
      2) **Hardware Schedule**: Hardware schedule listing all items to be furnished. The schedule shall include for each item: the quantities; manufacturer's name and catalog numbers; the ANSI number specified, sizes; detail information or catalog cuts; finishes; door and frame size and materials; location and hardware set identification cross-references to drawings; lock trim material thicknesses; lock trim material evaluation test results; corresponding reference standard type number or function number from manufacturer's catalog if not covered by ANSI or BHMA; and list of abbreviations and template numbers.
      3) **Keying**: Keying schedule developed in accordance with DHI Keying Systems, after the keying meeting with the user.
      4) **Certificates of Compliance**: The hardware manufacturer's certificates of compliance stating that the supplied material or hardware item meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of the product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply. A statement that the proposed hardware items appear in BHMA L & R Directory, BHMA Closer Directory and BHMA Exit Devices Directory directories of certified products may be submitted in lieu of certificates.
      5) **Buy American Act**: Furnish a separate certificate of compliance attesting that

hardware items comform to the Section 00700 Contract clauses pertaining to the Buy American Act.

f. Gypsum Board Products: Submit certification that gypsum board products, such as gypsum wallboard, gypsum backing board, cementitious backer units, and joint treating materials do not contain asbestos.

4. Before End of Closeout:
   a. Provide copies of all manufacturer warranties that extend for more than one year after completion.

END OF CHAPTER 111

CHAPTER B22

EXTERIOR WINDOWS AND OTHER OPENINGS

PERFORMANCE

A. Basic Function:

1. Fill, cover, close, or otherwise protect all openings in the exterior walls (other than doors) so that the entire exterior enclosure functions as specified, using windows and other opening elements as specified, without using components that must be installed at changes of season.

2. The elements comprising exterior windows and other openings include windows, fixed glazing other than glazed walls, ventilation openings, protection devices for openings, and elements that form or complete the openings, unless an integral part of another element.

3. Where exterior window and other opening elements also must function as elements defined in another element group, meet requirements of both element groups.

4. In addition to the requirements of this chapter, comply with all applicable requirements of Chapter 111 - Facility Performance, Chapter B - Shell, and Chapter B2 - Exterior Enclosure.

B. Amenity and Comfort:

1. Thermal Performance of Elements Forming Exterior/Interior Separation:
   a. Maximum Thermal Transmittance of Any Individual Component: U-value of 2.8 W/sq m K (0.50 Btu/sq ft/hr/deg F) when tested in accordance with ASTM C 236-1989(R93) or ASTM C 1199-2000.

2. Air Infiltration:
   a. Mechanical Ventilation Openings: Automatically closed when ventilation is not required. Unless ducted, maximum of 5 cu m/h/sq m (0.3 cfm/sq ft) of crack when closed, measured in accordance with ASTM E 283-1991(R99) at differential pressure of 75 Pa (1.57 psf).

3. Acoustical Performance:
   a. Window Sound Transmission Class: Minimum 31 STC, as measured in accordance with ASTM E 90-1999 and classified in accordance with ASTM E 413-1987(R99).

4. Appearance:
   a. Sight Lines of Glazed Areas: Provide maximum glazing area with minimum interruption by framing members.
   b. Frames: Design frames of openings to give a flush appearance without shadow lines.

C. Health and Safety:

1. Fire Resistance: Rating as required to maintain fire resistance rating of exterior wall in which they occur.

2. Forced Entry Resistance:
   a. Openings At the Ground Floor: Class I in accordance with ASTM F 1233-1998, minimum, and Grade 10, minimum, in accordance with ASTM F 588-1997.
   b. Openings Above the Ground Floor: Class I in accordance with ASTM F 1233-1998, minimum, and Grade 10, minimum, in accordance with ASTM F 588-1997

D. Structure:

1. Lintels: Constructed to span openings and support loads imposed by exterior wall; maximum deflection of 1/600 of span, vertically and horizontally.

2. Wind Design: No damage when tested in accordance with ASTM E 330-1997 at 1.5 times positive and negative design wind loads using 10 second duration of maximum load.

a. Members Supporting Glass: Maximum deflection of flexure limit of glass; with full recovery of glazing materials.

E. Durability:

1. Air Intake and Exhaust Openings: Minimize rainwater penetration and protect adjacent interior spaces from damage from water.

2. Water Penetration: Design openings and components of openings to positively drain water to exterior of the building.
   a. Top of Openings: If wall construction does not provide its own methods of drainage, use separate flashing to prevent water from entering opening components or the interior of the building.
   b. Bottom of Openings: Integral or separate sill or flashing to prevent water running over or draining out of opening components from entering the wall construction below or the interior of the building.

PRODUCTS

A. Windows (Operable and Fixed):

1. Do not use:
   a. Wood windows.
   b. Metal-clad wood windows.
   c. Plastic-clad wood windows.
   d. Tubular plastic windows.
   e. Composite windows.

B. Fixed Glazing:

1. Do not use:
   a. Storefronts.
   b. Wood windows.
   c. Metal-clad wood windows.
   d. Plastic-clad wood windows.
   e. Tubular plastic fixed windows.
   f. Composite windows.

C. Glazing:

1. Do not use:
   a. Ceramic glass.

2. **All exterior window glazing shall be laminated (2 ea. 1/8" annealed glass panes bonded together with a bonding interlayer, such as 0.030 inch (0.75 mm) polyvinyl-butryal (PVB).** **(AM#1)**

D. Other Exterior Opening Elements: All components required to complete the opening.

E. Lintels:

1. Do not use:
   a. Precast concrete.
   b. Stone.

F. Sills:

1. Do not use:
   a. Precast concrete.
   b. Unit masonry.

c. Stone.

END OF CHAPTER B22

CHAPTER B23

EXTERIOR DOORS

PERFORMANCE

A. Basic Function:

1. Secure all openings in the exterior wall that function to allow the entrance and exit of people, vehicles, and goods, so that the entire exterior enclosure functions as specified, using doors as specified, without using components that must be installed at changes of season.

2. The elements comprising exterior doors include doors of all sizes and uses, gates, and elements that form or complete the openings, unless an integral part of another element.

3. Where exterior door elements also must function as elements defined within another element group, meet requirements of both element groups.

4. In addition to the requirements of this chapter, comply with all applicable requirements of Chapter 111 - Facility Performance, Chapter B - Shell, and Chapter B2 - Exterior Enclosure.

B. Amenity and Comfort:

1. Thermal Performance:
   a. Maximum Thermal Transmittance of Any Individual Component: U-value of 1.7 W/sq m K (0.30 Btu/sq ft/hr/deg F) when tested in accordance with ASTM C 236-1989(R93).

2. Air Infiltration: Maximum of 1.1 cu m/hr/m (0.20 cfm/ft) of crack length, measured in accordance with ASTM E 283-1991(R99) at differential pressure of 75 Pa (1.57 psf).

3. Water Penetration: If so desired, provide justification for exemption of door openings from water penetration requirements of Chapter B and B2.

4. Acoustical Performance:
   a. Sound Transmission Class: STC values as follows, when measured in accordance with ASTM E 90-1999 and classified in accordance with ASTM E 413-1987(R99):
      1) Main Entrance Doors: STC 33.
      2) Other Pedestrian Doors: STC 36.
      3) Service Doors: STC 36.
      4) Bay Doors: STC 26.

5. Transparency:
   a. Provide pedestrian doors at building exits and exits from stairways to exterior with vision panels of at least 5 percent of door area.

6. Convenience and Accessibility:
   a. Door Handles and Knobs: As required by code; where code and other requirements allow an option exit devices are preferred.
   b. Mode of Operation: Self-closing, with manual hold-open, unless otherwise indicated.
   c. Power-Assisted and -Operated Door Control:
      1) Local actuators each side unless otherwise indicated.
      2) Use least obtrusive method of control/actuation possible.
      3) Access Control System: As specified in Chapter D92.
      4) Bay Doors: Local actuators].

C. Health and Safety:

1. Emergency Egress:
   a. Provide minimum building exit width to accommodate occupant load.
   b. Provide exit doors minimum 914 mm (36 inches) wide.

2. Fire Resistance:
   a. Doors Required by Code to be Fire Resistive: Fire resistance rating as required by code, for fire resistance rating of exterior wall in which doors occur, tested in accordance with a method acceptable to local authorities.
   b. Doors into Stairs: Maximum 232 degrees C (450 degrees F) temperature rise rating at 30 minutes standard fire test exposure.

3. Physical Security:
   a. Doors non-removable from outside without use of key.
   b. At Locations Not Facing a Street: No glazing.
   c. Secure each exterior door using a "fail-secure" method that allows entrance plus exit from inside using only one motion.
      1) Keys: Type as required to minimize unauthorized entry.
   d. Forced Entry: Provide doors capable of resisting forced entry equivalent to:
      1) Swinging Doors: ASTM F 476-1984(R96) Grade 10.
      2) Sliding Doors: ASTM F 842-1997 Grade 10.

4. Glazing in Doors: Comply with requirements for safety glazing, security, and forced entry specified in Chapters B and B2.

D. Structure:

1. Lintels: Constructed to span door openings and support loads imposed by exterior wall with maximum deflection vertically and horizontally of 1/600 of span.

2. Door Frames: Constructed to span door opening with maximum deflection vertically and horizontally of 1/600 of span.

E. Durability:

1. Water Penetration: Design openings and components of openings to positively drain water to exterior of the building.

F. Operation and Maintenance:

1. Service Life Span of Operating Components: Remaining operable for 10 years under normal exposure conditions for the project site.

2. Ease of Use and Repair: Provide doors that will be easy to use by occupants, easy to repair or service, and with operating components easy to replace.

PRODUCTS

A. Main Entrance Doors:

1. **deleted by (AM#1)**

B. Other Pedestrian Doors:

1. Do not use:
   a. Glazed doors.
   b. Wood doors and frames.
   c. Plastic doors and frames.
   d. All-glass entrances.

C. Garage Doors:

1. Do not use:
   a. Vertical lift doors.
   b. Side coiling doors.
   c. Stainless steel doors.

d. Wood doors.

D. Other Large Doors:

1. Do not use:
   a. Vertical lift doors.
   b. Side coiling doors.
   c. Stainless steel doors.
   d. Aluminum doors.
   e. Wood doors.

E. Lintels:

1. Do not use:
   a. Precast concrete.
   b. Stone.

F. Sills:

1. Do not use:
   a. Precast concrete.
   b. Unit masonry.
   c. Stone.

G. Joint Sealers: Same as specified in Chapter B21.

H. Glazing in Doors: Glass and plastic.

1. **deleted by (AM#1)** ____.

2. **deleted by (AM#1)**

3. **All exterior door glazing shall be laminated (2 ea. 1/8" annealed glass panes bonded together with a bonding interlayer, such as 0.030 inch (0.75 mm) Polyvinyl-butryal (PVB). (AM#1)**

I. Door Louvers:.

1. Louvers in Metal Doors: Same material as doors.

2. Use fire rated louvers on fire rated doors.

J. Hardware for Swinging Doors:

1. Use satin, stainless steel finish.

2. Use fire rated hardware on fire rated doors.

3. Hinges: Ball-bearing butt hinges.

4. Exit Devices: Unless specifically indicated as one type, rim type or exposed vertical rod type.

5. Locksets: Unless specifically indicated as one type, bored (cylindrical).

6. Door Closers: Unless specifically indicated as one type, surface overhead frame-mounted type, surface overhead door-mounted type, concealed overhead frame-mounted type, or concealed overhead door-mounted type.

7. Door Stops: Unless specifically indicated as one type, floor-mounted type, wall-mounted type, or overhead door/frame mounted type.

8. Door Hold-Opens: Unless specifically indicated as one type, floor-mounted type, wall-mounted type, or overhead door/frame mounted type.
   a. Do not use floor-mounted type, wall-mounted type, overhead-mounted type, hold-open

feature in closer alone without a separate stop, or magnetic hold-open type.

END OF CHAPTER B23

CHAPTER B24

EXTERIOR WALL FIXTURES

PERFORMANCE

A. Basic Function:

1. Exterior wall fixtures include all elements attached to the outside of the exterior walls, unless consisting of equipment or services fixtures. Fixtures required are those made necessary by the design and the following:
   a. **Main Building Identification Signs: Mounted as high as possible, for visibility from a great distance; provide Building Numbers as follows: Maintenance Tactical Shop #40060, Sentry Building #40059, POL Building #40065, and Loading Dock #49016. (AM#1)**
2. Where exterior wall fixtures also have a function defined in another element group, design such elements as specified for that element group, in addition to the requirements specified in this Chapter.
3. In addition to the requirements of this chapter, comply with all applicable requirements of Chapter 111 - Facility Performance, Chapter B - Shell, and Chapter B2 - Exterior Enclosure.

END OF CHAPTER B24

CHAPTER C

INTERIORS

PERFORMANCE

A. Basic Function:

1. Provide appropriately finished interiors for all spaces indicated in the program, equipped with interior fixtures as required to function properly for specific occupancies.

2. Interiors comprise the following assemblies:
   a. Interior Construction: All elements necessary to subdivide and finish space enclosed within the shell, including applied interior surfaces of the exterior enclosure.
   b. Interior Fixtures: All elements attached to interior construction that add functionality to enclosed spaces, except for elements classified as equipment or services fixtures.

3. Provide physical separation between spaces, constructed to achieve fire ratings required by code, appropriate security between adjacent spaces, and visual, acoustical, olfactory, and atmospheric isolation as necessary to maintain desirable conditions in each space.

4. Provide finishes for interior surfaces that are appropriate for the functions of each space.

5. Provide interior fixtures that are necessary for the proper functioning of each space.

6. Where interior elements also must function as elements defined within another element group, meet requirements of both element groups.

7. In addition to the requirements of this chapter, comply with all applicable requirements of Chapter 111 - Facility Performance.

B. Amenity and Comfort:

1. Natural Ventilation: Design and construct interiors to permit air movement between exterior openings positioned to enhance warm weather thermal comfort of occupants in all major spaces.
   a. SR1 (Sanitary Facilities), SS (Storage), SV (Vehicular), SC (Circulation), and SU (Utility, Building Services) spaces are exempt from natural ventilation requirements.
   b. Substantiation:

2. Access: Provide access to all primary interior spaces from Circulation spaces (SC Spaces) (no access to any primary interior space exclusively through another primary interior space).

3. View: Provide views to the building exterior from most locations within primary interior spaces.
   a. View spaces include the following types:
      1) Occupant Work (SP2 Spaces).
      2) Equipment Utilization (SP3 Spaces).
      3) Assembly (SP5 Spaces).

4. Natural Light:
   a. Daylighting: Provide ambient natural lighting in primary spaces that is of intensity adequate for essential tasks when measured on a typical overcast winter day in midafternoon.
      1) Spaces for daylighting include the following types:
         a) Occupant Work (SP2 Spaces).
         b) Equipment Utilization (SP3 Spaces).
         c) Assembly (SP5 Spaces).
      2) Light Levels: Provide minimum light levels not less than those recommended in IESNA Lighting Handbook, 2000, for the types of tasks to be anticipated in each category of space.
   b. Visual Comfort: Provide ambient natural light in primary spaces that is free of excessive

direct or reflected glare, as defined in IESNA RP-5, 1999, Recommended Practice of Daylighting.

c. Daylight Control: Provide local devices to enable occupants to control brightness and glare from direct daylighting.
   1) Window treatments as specified in Chapter C23 are acceptable methods of complying with this requirement.

5. Acoustical Performance:
   a. Background Noise: Provide interiors that maintain ambient sound levels within primary spaces at levels recommended in ASHRAE HVAC Applications Handbook, 1999, when adjacent spaces are occupied and are being used normally.
   b. Impact Insulation: Provide floor-ceiling construction, including floor structure, floor finish, and ceiling finish, to produce Field Impact Insulation Class (FIIC) values as follows, when tested in accordance with ASTM E 1007-1997:
      1) Minimum for Floor-Ceiling Construction Over Moderately Noisy Spaces (NC values of 30-40): FIIC 57.
      2) Minimum for Floor-Ceiling Construction Over Noisy Spaces (NC values of 40-50): FIIC 52.

6. Appearance: Provide interiors that are pleasing in appearance and do not detract from the primary functions performed in each space.

7. Texture: Provide interior elements and surfaces that are textured appropriately for primary functions to be accommodated within each space.
   a. For surfaces that are within normal reach of occupants, provide textures that are safe for occupants and require minimum maintenance.
   b. For surfaces that are not within normal reach of occupants, provide textures that are comparable to those within normal reach.

C. Health and Safety:

1. Egress: Provide egress from all interior spaces in accordance with code.

2. Fire Resistance: Design and select materials to provide fire resistance in accordance with code.
   a. For all elements required to have a fire resistive rating and which are not made of materials and systems specified as acceptable by the code, use proven-by-mock-up construction.
   b. For proven-by-mock-up construction, acceptable testing agencies are Underwriters Laboratories Inc., Inchcape Testing Services (Warnock-Hersey), and Factory Mutual
   c. Minimum performance values for individual interior elements are also specified in other chapters.

D. Structure:

1. Structural Performance: Provide interior construction and fixtures to support without damage all loads required by code.
   a. Special Loads: In addition to loads defined by code, provide for adequate support of wall-mounted or ceiling-mounted furnishings and equipment in spaces where such equipment is required by program or is likely to be installed after construction because of intended function.
      1) Adequate support is defined as the ability to sustain 150 percent of design loads without damage to building or equipment.
   b. Supports Ceilings and Lighting Fixtures: Attached to, and supported by, the superstructure, not to or by non-structural construction or sheet metal elements, so that they do not move or sag, using the following:
      1) Supports capable of handling seismic forces in accordance with the code.

E. Durability:

1. Service Life Span: Same as building service life, except as follows:
   a. Interior Doors and Other Operable Elements: Minimum 15 years functional and aesthetic service life.
   b. Interior Ceiling Finishes: Minimum 15 years functional and aesthetic service life; including suspended ceilings.
   c. Interior Wall and Floor Finishes: Minimum 10 years functional and aesthetic service life.
   d. Other Interior Construction: Minimum 15 years functional and aesthetic service life.
2. Wear Resistance: Provide interior construction and fixtures that are suitable in durability for the degree and type of traffic to be anticipated in each space.
3. Water Resistance: At maintenance facilities, provide interior construction and fixtures that will not be damaged by water or high humidity.
4. Corrosion Resistance: At maintenance facilities, provide interior construction materials and fixtures that are inherently resistant to corrosion and rot.

F. Operation and Maintenance:

1. Cleaning: Provide interior construction and fixtures that will not be damaged by ordinary cleaning and maintenance operations.

PRODUCTS

A. Design and construct interiors using the following materials and systems:

1. Cast-in-place concrete.
2. **Clay masonry units (am#1)**.

B. Do not use:

1. Exposed wood.
2. Particleboard of any type.
3. Wood framing.

END OF CHAPTER C

CHAPTER C24

ACCESSORY FIXTURES

PERFORMANCE

A. Basic Function:

1. Provide accessory fixtures as required to accomplish the design as required by code and as indicated in the project program.
   a. Mirrors:
      1) One for each lavatory, unless otherwise indicated.
   b. Waste receptacles.
      1) One for each paper towel dispenser.
   c. Holders and dispensers for toilet and lavatory supplies furnished by Government.
      1) Toilet Paper: Roll, consumer-size; one dispenser per toilet.
      2) Towels: Paper, in rolls; one dispenser per 3 lavatories.
   d. Telecommunications Fixtures: Fixed mountings and enclosures for sound and data communications equipment and supplies.
      1) Public telephones, including telephone instrument, secured directories, and no seat.
      2) Public computer workstations, including modem outlet, work surface, and seat.
      3) Public fax station, including equipment mounting and work surface.
   e. Visual Display Fixtures: Configuration and surface area as indicated in the program.
      1) Tackable surfaces, which are identified in the program as tackboards, for standard push pin use.
      2) Tackless paper holders.
2. Where accessory fixtures also must function as elements defined within another element group, meet the requirements of both element groups.
3. In addition to the requirements of this chapter, comply with all applicable requirements of Chapter 111 - Facility Performance, Chapter C - Interiors, and Chapter C2 - Interior Fixtures.

B. Health and Safety:

1. Broken Glass Hazard: Provide only fully tempered float glass for glass in fixtures.
2. Physical Security of Users of Postal and Telecommunications Fixtures: Fixtures and environs designed and located so as to minimize theft and attacks on users, using principles specified in Chapter 111, and to create obvious impression of safety.

PRODUCTS

A. Toilet, Bath, and Laundry Accessories: (10800)

1. Use one of the following:
   a. **Paper Towel Dispenser. Paper Towel Dispenser shall be Fort Hood's base standard; Georgia-Pacific Model #84T, Eclipse Quickview, Lever Control, Roll Tower Dispeser, Color: Smoke, or approved equal.** **(am#1)**
2. Do not use:
   a. Brass accessories.

B. Erasable Surfaces: (10100)

1. Do not use:
   a. Natural slate.
   b. Marker fabric wallcovering.
   c. Painted surfaces.

C. Tackable Material: (10100)

1. Do not use:
   a. Linoleum.
   b. Wood fiberboard.
   c. Gypsum board.

D. Visible Surfaces of Tackable Surfaces:

1. Do not use:
   a. Vinyl wall covering.
   b. Linoleum.

END OF CHAPTER C24

CHAPTER D22

PLUMBING FIXTURES

PERFORMANCE

A. Basic Function:

1. Provide plumbing fixtures necessary for occupancy, use, and sanitation.

2. Fixtures Required: As specified by code.
   a. Watercloset: In each restroom.
   b. Urinals: in mens restrooms.
   c. Lavatories: At public and private restrooms and bathrooms.
      1) Group lavatories may be used wherever 4 or more lavatories would be required in a single room; 460 mm (18 inches) of group lavatory perimeter qualifies as a substitute for one lavatory.
   d. Kitchen Sink: Double compartment; one in breakroom.
   e. Service Utility Sink: One in each janitor's closet.
   f. **(am#1)** Sinks (**used** Oil and Antifreeze Drain Unit): One at each column in Repair Bays.
   g. Showers: One in each indicated shower compartment.
   h. Electric Water Cooler:number and locations per code.
   i. Emergency Shower \ Eye Wash: One in each Repair Bay wing, one in paint shop, one in each General Item Repair room on 1st floor and one in Compact Item Repair on 2nd floor.
   j. Wash Fountain: Semi-circular with foot bar and push bar opening. Minimuim of One.
   k. Utility Water Supply: One in each SU1 space.
      1) Outdoor Supplies: Not more than 15 m (50 feet) apart on building facade and one on each facade of building.

3. Fixtures Required: As specified by code.
   a. Watercloset: In each restroom.
   b. Urinals: in men restroom.
   c. Showers: _one in each men and women restroom first floor.
   d. Lavatories: In each restroom.
   e. Kitchen Sinks: Double compartment; one in each breakroom.
   f. Electric Water Cooler:
   g. Wash Fountain.
   h. Mop Service Basin.
   i. Emergency Shower / Eye Wash.
   j. Non-Freeze Wall Hydrant.
   k. Hose BIBB.

4. Where plumbing fixture elements must also function as elements defined within another element group, meet requirements of both element groups.

5. In addition to the requirements of this chapter, comply with all applicable requirements of Chapter 111 - Facility Performance, Chapter D - Services, and Chapter D2 - Water and Drainage.

B. Amenity and Comfort:

1. Convenience:
   a. Provide space between and around fixtures as required by code.
   b. Faucets: Single action operation in the following locations.
      1) Restrooms.
      2) Break room.

2. Appearance:
   a. Smooth, corrosion-resistant, non-absorbent, with no crevices to collect dirt.

b. Aesthetically pleasing and easy and comfortable to use; high style appearance is very important.
c. Color: White, except where metal fixtures are required.

C. Health and Safety:

1. Disease and Infection:
a. All openings and edges around the sides and bottom of each fixture permanently sealed with waterproof material.

D. Structure:

1. Anchor fixtures to support weight of fixtures and a minimum of 180 kg (400 pounds) without failure or stress on the connecting pipes.

2. Wall Mounted Fixtures: Carriers concealed inside fixture and in wall or floor.

E. Durability:

1. Expected Service Life Span of Faucet Valves: 20 years.

2. Expected Service Life Span of Flushing Mechanisms: 20 years.

3. Wear Resistance: Provide fixtures, trim and accessories that are resistant to corrosion, breakage, scratching, burning, fading and chipping due to continual contact with water, human usage, and cleaning with abrasive materials.

F. Operation and Maintenance:

1. Fixture Functions:
a. Lavatories: Standard spout, with integral overflow.
b. Urinals: Siphon jet flushing action.
c. Water Closets: Siphon jet flushing action.
d. Showers: With single-action hot-cold mixing valve.
e. Kitchen Sinks: Swivel spout, water spray nozzle.
f. Drinking Fountains: **With hand operation,chilled water service.** **(am#1)**
g. Utility (Mop or Janitor's) Sinks: Filling of standard rolling mop bucket required; spout designed to support full bucket of water. Combination bacflow preventer and vacuum breaker required on spout

2. Water Pressure/Flow At Fixtures: 55.2 kPa (8 psi), minimum, except as otherwise required by code.
a. Showers: 138 kPa (20 psi), minimum.
b. Flush Valves at Water Closets and Urinals: 138 kPa (20 psi), minimum.

3. Water Consumption:
a. Water Closets: 6 liters (1.6 gallons) per flush, maximum, with complete waste removal in one flush.
b. Urinals: 3.8 liters (1.0 gallon) per flush, maximum, with complete waste removal in one flush.
c. Lavatory Faucets in Public Restrooms: 0.95 liters (0.25 gallon) per use.
d. Lavatory Faucets in Other Areas: 0.95 liters (0.25 gallon) per use.
e. Shower Heads: 9.5 liters (2.5 gallons) per minute, maximum.
f. Drinking Fountains: 9.5 liters (2.5 gallons) per minute.

4. Maintenance Service:
a. Electrically-Powered Fixtures: Battery-power operation not allowed.

5. Ease of Cleaning:
a. Use wall-mounted fixtures in public restrooms, for ease of cleaning floors.

b. Provide adequate access for cleaning each fixture and the areas around it.

6. Ease of Repair:
   a. Each pipe connection to each fixture provided with a stop valve, for easy disconnection from water service.
   b. Provide access to all concealed connections, such as floor and wall cleanouts and slip-joint connections.

PRODUCTS

A. Water Closets:

1. Use one or more of the following:
   a. External flush valve type.
   b. Vitreous china.
   c. Wall mounted fixtures.

B. Urinals:

1. Use one or more of the following:
   a. Vitreous china.
   b. Wall mounted fixtures.

C. Lavatories:

1. Use one or more of the following:
   a. Vitreous china.
   b. Ceramic, non-vitreous china.
   c. Countertop-mounted fixtures.
   d. Wall-hung fixtures.

D. Kitchen Sink:

1. Use one or more of the following:
   a. Stainless steel.
   b. Countertop-mounted fixtures.
   c. Self Rimming.

E. Emergency Shower:

1. Use one or more of the following:
   a. Corrosion- resisting steel..
   b. Pedestal mount

F. Showers:

1. Use one or more of the following:
   a. Precast terrazzo receptors.
   b. Pressure - balancing mixing valve.
   c. Wall mount.

G. Faucets and Trim:

1. Use the following:
   a. Polished chrome-plated finish.

H. Drinking Fountains:

1. Use one or more of the following:
   a. Electric water coolers.
   b. Stainless steel finished units.

c. Surface wall mount.

I. Service Utility (Mop or Janitor's) Sinks:

1. Use one or more of the following:
   a. Precast terrazzo.
   b. Corner Floor-mounted fixtures.

J. Wash Fountain:

1. Use one or more of the following:

2. Precast terrazzo.

3. Semicircular fixtures.

END OF CHAPTER D22

CHAPTER D3

HVAC - HEATING, VENTILATING, AND AIR CONDITIONING

PERFORMANCE

A. Basic Function:

1. Provide artificial means of controlling temperature, relative humidity, velocity, and direction of air motion in the interior spaces enclosed by the shell, and reduction of airborne odors, particulates, and contaminant gases.

2. The HVAC system consists of the following elements:
   a. Energy Supply (D31): Elements which provide energy used to maintain building comfort.
   b. Heat Generation (D32): Elements required to heat building to maintain space comfort.
   c. Refrigeration (D33): Elements necessary to generate the cooling required to maintain building comfort.
   d. Air Distribution (D34): Elements required to distribute air to maintain building comfort.
   e. HVAC Controls (D36): Elements required to control equipment which maintains building comfort.
   f. Emergency air handler unit shut off switch accessible by occupants, condenser 10 Feet from building.

3. Where HVAC elements also must function as elements defined within another element group, meet the requirements of both element groups.

4. In addition to the requirements of this chapter, comply with all applicable requirements of Chapter 111 - Facility Performance and Chapter D - Services.

B. Amenity and Comfort:

1. Space Temperature Setpoint: As specified in Chapter 111.

C. Health and Safety:

1. Outdoor Air Intakes: Locate all outside air intakes minimum of 3m (10ft) above grade to meet anti-terrorism requirements.

2. Locate exterior HVAC equipment 10m (33ft) from exterior wall of building to meet anti-terrorism requirements.

3. **Standard Equipment Bracing: Design all overhead equipment mountings to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction. This standard does not preclude the need to design equipment mountings for forces required by other criteria such as seismic standards. (AM#1)**

4. Electrical Shock Prevention:
   a. Provide a means of disconnecting power at each piece of equipment.

5. Refrigerants:
   a. Comply with the requirements of ASHRAE 15-1994.
   b. Prevent release of refrigerant to atmosphere.
   c. Prevent exposure of occupants to hazardous refrigerants.

6. Indoor Air Quality: Provide sufficient ventilation to obtain acceptable indoor quality, determined using the Ventilation Rate Procedure of ANSI/ASHRAE 62-1999 .

D. Operation and Maintenance:

PRODUCTS

A. HVAC System Type:

1. Use one or more of the following:
   a. Stand-Alone HVAC Systems:
      1) Forced-draft, natural gas furnace with split-system cooling.
      2) Air-cooled, self-contained air handlers.
      3) Gas Fired, vented, high intensity radiant tube heaters. (Repair Bays, Warehouse).
      4) Gas Fired Unit heaters (Utility and POL).
      5) Gas fired heating-ventilating and make-up air units (**Welding Bay (AM#1)).**
      6) Exhaust Fans (Maintenance Pit, Repair Bays, Warehouse, Toilets).
      7) Supply Fans (Utility)
      8) Welding Exhaust System.
      9) Overhead Vehicle Tailpipe Exhaust System.(Repair Bays)
      10) Condenser Unit.
      11) Gas Fired Domestic Water Heater.
   b. Central HVAC Systems:
      1) Central chilled water and hot water heating systems with fan coil units and air handlers.
      2) Chilled water supplied by an air-cooled chiller.

END OF CHAPTER D3

CHAPTER D32

HEAT GENERATION

PERFORMANCE

A. Basic Function:

1. Provide the necessary equipment and infrastructure to deliver heat to the conditioned spaces.
2. Where HVAC elements also must function as elements defined within another element group, meet the requirements of both element groups.
3. In addition to the requirements of this chapter, comply with all applicable requirements of Chapter 111 - Facility and Performance, Chapter D - Services, and Chapter D3 - HVAC.

B. Health and Safety:

1. Hazards: Provide boilers and furnaces which safeguard people, property and equipment from the following potential hazards:
   a. Exposure to open flames.
   b. Exposure to hot surfaces.
   c. Exposure to carbon monoxide.

C. Durability:

1. Temperature Endurance: Provide equipment designed for ambient temperatures ranging from minus 15 deg C to 50 deg C (5 deg F to 122.
2. Chimneys and Flues: Provide flues designed for flue gas temperature of 204 degrees C (400 degrees F).
3. **Not Used (am#1)**

D. Operation and Maintenance:

1. Ease of Use: Design access to and working clearances around heating equipment as recommended by the manufacturer.

PRODUCTS

A. **Not Used (am#1)**

B. Furnaces:

1. Use the following:
   a. Horizontal gas-fired furnaces.

C. Flues:

1. Use one or more of the following:
   a. Double-walled; aluminum inner and galvanized outer Type B gas vents.
   b. Double-walled; stainless steel inner and aluminum coated steel outer duct.
   c. Double-walled; stainless steel inner and aluminum coated steel outer duct with 1 inch (2.5 cm) thick insulation between inner and outer walls.

END OF CHAPTER D32

CHAPTER D6

ARTIFICIAL LIGHTING

PERFORMANCE

A. Basic Function:

1. Provide artificial means of lighting interior and exterior spaces.
2. Artificial lighting comprises the following elements:
   a. Interior Lighting: General room lighting, emergency lighting, and accent lighting. In high bay areas, provide lighting fixture type which can be brought down for ease of changing light bulb.
   b. **Provide interior lighting for POL storage building. (am#1)**
   c. Exterior Area Lighting (D62): General lighting of exterior spaces including hardstand areas, driveways and parking areas.
3. Portable lamps (not permanently attached to the building) may not be used to accomplish required artificial lighting.
4. Design lighting in accordance with recommendations of the Illuminating Engineering Society of North America IESNA-2000.
5. Fluorescent fixtures shall be served by electronic ballasts.
6. Provide occupancy sensors in areas such as toilets, stairs, conference rooms, janitor closet, break room.

END OF CHAPTER D6

CHAPTER E19

OTHER EQUIPMENT

PERFORMANCE

A. Basic Function:

1. Other equipment comprises the following elements:
   a. Parts or item wash equipment, including one "Hotsy" type packaged hot water wash unit for parts washing in scheduled maintenance bay and one packaged hot water wash unit for the vehicle wash bay.
   b. **(am#1)** Vehicular service equipment, including used oil collection, used antifreeze collection, off-spec fuel collection, engine oil (50 wt.) dispensing, antifreeze dispensing, gear lube oil dispensing, transmission fluid dispensing, chassis lube (grease) dispensing, .
   c. Vehicle exhaust collection equipment, including high temperature flexible exhaust hoses with vehicle adapters and hose reels.
   d. Compact Item Repair Shop and General Item Repair Shop adjustable local exhaust nozzles.
   e. Welding shop downflow benchs and spring balanced adjustable flex hose local exhaust nozzles.
   f. Brake shop downflow work bench with HEPA filtration.

B. Amenity and Comfort:

1. Parts/Vehicle wash unit: Provide stationary unit affixed to slab. Provide electric motor, belt drive, positive discplacement pump. Provide trigger actuated hand held nozzle with hose. Provide a wall mounted adjustable timer for automatic unit shutdown. Minimum capacit shall be 0.19 L/s at a discharge pressure of 8270 kPa. Provide a gas fired water heating section for the item wash unit. Provide adjustable pattern spray tips or assorted pattern spray tips for each unit.

2. **(am#1)** Vehicular service equipment: Overhead hose reel shall be provided between each two scheduled maintenance bays for engine oil, antifreeze coolant, chassis grease, transmission fluid, and gear lube oil dispensing. Each dispensing hose for liquids shall be provided with dispensing meter. In addition, regulated compressed air station with duplex quick connectors and domestic water hose bibs shall be available at each column between shop service bays. Chassis lube and compressed air hose, reel, and dispensing regulator shall be provided in each service and inspection pit. **used** oil and **used** antifreeze receptors shall be provided at columns between each two service bays. The waste from the receptors shall be collected by a piped collection system and pumped to exterior **used** oil and **used** antifreeze storage tanks. Any collection piping located below grade shall be in double wall containment piping with leak detection system. Two rolling or slide out catch basins shall be provided in the service pit for collection of **used** oil and **used** antifreeze. These catch basins shall, through a flexible hose and diaphragm pump, transfer the received waste fluid to the appropriate storage tank. The **used** oil and **used** antifreeze tanks shall each be 1000 gallon capacity, double wall, concrete encased, above ground storage tanks. An off-spec fuel storage tank similar to the **used** oil tank shall also be provided. The contractor shall develop a method of receiving off-spec fuel from a catch pan and transfer if to the storage tank. **The designer is required to provide a laminated card with step-by-step operating procedures required for system start up, operation and shutdown located near the pump control valve or switch. (am#1)**

3. Vehicle exhaust collection equipment: Hose reel shall be electric motor operated.

4. Compact Item Repair & General Item Repair Shops shall each be provided with a spring balanced, flexible hose, local exhaust with flanged nozzle. The exhaust shall be wall mounted and shall have a 10 ft. radius of reach. Exhaust cfm shall be adequate to produce 100 fpm capture velocity at 6 to 9 inches from the nozzle. The exhaust fan shall be remotely located to minimize noise but shall be easilly accessible for maintenance. Local exhaust shall be

manually switched. Exhaust discharge shall be to the exterior of the building.

5. Welding shop downflow benches and local exhaust nozzles. Provide (4) four 2.3' x 3' downflow welding benchs. Provide (4) four spring balanced, adjustable position, flex hose, local exhaust nozzles with flanged nozzles. Downflow benches and local exhaust nozzles shall be manifolded to a single exhaust fan. discharge shall be to the exterior of the building. Flowrate of benches shall be 200 cfm/sf of benchtop area. Flowrate of local exhaust nozzles shall be 1000 cfm each.

6. Brake shop downflow work bench shall be 5' x 3' with slotted or perforated, heavy duty steel work surface. The bench shall have a fixed rear shield and removable side shields to aid air flow and particulate capture. The work surface shall support a minimum concentrated load of 500 lbs and a minimum distributed load of 1200 lbs. The bench shall have an integral or separate exhaust fan and HEPA filtration section as well as integral cleanout doors and internal dust trays. The bench exhaust shall be discharged to the exterior of the building. Flowrate of the bench shall be 200 cfm/sf of benchtop area.

C. Health and Safety:

1. **Deleted by am#1.**

2. Vehicle service equipment:

3. Ventilation equipment shall be designed in accordance with ACGIH Industrial Ventilation manual of recommended practice.

PRODUCTS

A. Construct using equipment and materials specified in section 15487, Vehicle Maintenance Equipment, located in volume IV.

METHODS OF CONSTRUCTION

A. Construct using the methods specified in section 15487, Vehicle Maintenance Equipment, located in volume IV.

END OF CHAPTER E19

SECTION 02746

RESIN MODIFIED PAVEMENT SURFACING MATERIAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO MP 1	(1998)Provisional Specification for Performance Graded Asphalt Binder

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 127	(1988; R 1993el) Specific Gravity and Absorption of Coarse Aggregate
ASTM C 128	(1997) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 150	(1999a) Portland Cement
ASTM C 566	(1997) Evaporable Total Moisture Content of Aggregate by Drying
ASTM C 618	(1999) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM D 70	(1982; R 1997) Specific Gravity and Density of Semi-Solid Bituminous Materials
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 140	(2000) Sampling Bituminous Materials
ASTM D 995	(1995b) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
ASTM D 1461	(1985; R 1994) Moisture or Volatile

	Distillates in Bituminous Paving Mixtures
ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2041	(1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen From Bituminous Paving Mixtures
ASTM D 2216	(1998) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 3381	(1992; R 1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 4125	(1994el)Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate
ASTM D 6307	(1998) Asphalt Content of Hot Mix Asphalt by Ignition Method

CORPS OF ENGINEERS (COE)

COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Samples

Open Graded Asphalt Job Mix Formula; GA,
Job Mix Formula for Slurry Grout; GA,

Materials required to produce the open graded asphalt mixture and slurry grout job-mix-formulas in the quantities indicated below.

Aggregates representing each stockpile to be used in the production of the open-graded asphalt mixture: 45 kg each

Bituminous Material 19 liters
Slurry Grout Sand 23 kg

Fly Ash	23 kg
Cement	23 kg
Cross Polymer Resin	4 liters

Samples shall be delivered, along with the Contractor's preliminary job mix formulas, 60 days before starting production to the Central Texas Resident Office.

SD-06 Test Reports

Coarse Aggregate; GA
Coarse and Fine Aggregates; GA
Open-Graded Mix Aggregate; GA
Bituminous Material; GA
Slurry Grout Sand; GA
Filler (Fly Ash); GA
Job Mix Formula for Slurry Grout; GA
Contractor Quality Control; GA
Contractor qualifications shall show that he has been engaged in the successfull installation of Resin Modified Pavement for at least one previous project; GA

Aggregate and QC test results. Slurry grout viscosity tests shall be conducted immediately prior to application on the pavement surface and 30 minutes thereafter.

SD-07 Certificates

Cement; GA
Cross Polymer Resin; GA
Curing Compound; GA

Copies of certificates.

1.3 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.3.1 Asphalt Mixing Plant

The bituminous asphalt plant shall have enough capacity to produce the quantities of bituminous mixtures required for the project. Plants used for the preparation of hot-mix asphalt shall conform to the requirements of ASTM D 995 with the following changes:

a. Testing Facilities. The Contractor shall provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

b. Storage Bins. Use of storage bins for temporary storage of hot-mix asphalt will be permitted as follows:

(1) The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 1 hour.

(2) The asphalt plant shall have enough capacity to produce the quantities of asphalt mixtures required for the project. Hauling equipment, paving machines, rollers, miscellaneous equipment, and tools shall be provided in sufficient numbers and capacity and in proper working condition to place the asphalt paving mixtures at a rate equal to the plant output.

1.3.2 Asphalt Paver

Asphalt pavers shall be self-propelled, with an vibrating screed, heated as necessary, and shall be capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1.3.3 Receiving hopper

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

1.3.4 Automatic Grade Control

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. The transverse slope controller shall not be used to control grade. The controls shall be capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 9.14 m in length.

b. Taut stringline set to grade.

c. Short ski or shoe for joint matching.

d. Laser control.

1.3.5 Slurry Grout

The additional requirements for production of slurry grout for the Resin Modified Pavement (RMP) are a concrete batch plant, a ready mix truck, or portable mixer for grout mixing, and small 1.8 metric ton (2 ton) (maximum) tandem steel wheeled vibratory roller for compaction of RMP.

1.4 SAMPLING AND TESTING

1.4.1 Aggregates

1.4.1.1 General

ASTM D 75 shall be used in sampling coarse and fine aggregates. Points of sampling will be designated by the Contracting Officer. All tests necessary to determine compliance with the specified requirements shall be made by the Contractor, using a Corps of Engineers certified Commercial Laboratory.

1.4.1.2 Sources

Sources of aggregates shall be selected well in advance of the time when the materials are required in the work. Samples shall be submitted 60 days before starting production. If a sample of material fails to meet the specified requirements, the material represented by the sample shall be replaced, and the cost of testing the replaced sample shall be at the Contractor's expense. Approval of the source of the aggregate does not relieve the Contractor of the responsibility to deliver aggregates that meet the specified requirements.

1.4.2 Bituminous Materials

Samples of bituminous materials shall be obtained in accordance with ASTM D 140. Sources shall be selected well in advance of the time materials will be required for the work. In addition to the initial qualification testing of bituminous materials, samples shall be obtained and tested before and during construction when shipments of bituminous materials are received, or when necessary to assure that some condition of handling or storage has not been detrimental to the bituminous material.

1.5 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.5.1 Mineral Aggregates

Mineral aggregates shall be delivered to the site of the bituminous mixing plant and stockpiled in such a manner as to preclude segregation or contamination with objectionable material.

1.5.2 Bituminous Materials

Bituminous materials shall be maintained below a temperature of 150 degrees C during storage and shall not be heated by the application of a direct flame to the walls of storage tanks or transfer lines. Storage tanks, transfer lines and weigh buckets shall be thoroughly cleaned before a different type or grade of bitumen is introduced into the system.

1.5.3 Slurry Grout Sand

Slurry grout sand shall be stored at the grout production site to prevent contamination with foreign materials and saturation with rain water. Moisture content of this sand shall be determined just prior to grout production so that corrections to the job mix formula water content can be made to compensate for any moisture in the sand.

1.5.4 Cementitious Materials

The temperature of the cementitious materials, as delivered to storage at the site, shall not exceed 65 degrees C.

1.6 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the bituminous plant for checking adequacy of any equipment in use; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking temperatures maintained in preparation of the mixtures.

PART 2 PRODUCTS

2.1 AGGREGATE

Aggregate shall consist of crushed stone, or crushed gravel without sand or other inert finely divided mineral aggregate. The portion of materials retained on the 4.75 mm sieve shall be known as coarse aggregate, the portion passing the 4.75 mm sieve and retained on the O.075 mm sieve as fine aggregate. Sieve analysis of coarse and fine aggregates shall be conducted in accordance with ASTM C 136.

2.1.1 Coarse Aggregate

Coarse aggregate shall consist of sound, tough, durable particles, free from adherent films of matter that would prevent thorough coating with the bituminous material. The percentage of wear shall not be greater than 40 percent when tested in accordance with ASTM C 131. The magnesium sulfate soundness loss shall not exceed 18 percent, after five cycles, when tested in accordance with ASTM C 88. Aggregate shall contain at least 75 percent by weight of crushed pieces having two or more fractured faces. The area of each fractured face shall be equal to at least 75 percent of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be obtained by artificial crushing.

2.1.2 Crushed Aggregates

Particle shape of crushed aggregates shall be essentially cubical. Quantity of flat (width to thickness ratio greater than 3) and elongated particles (width to length ratio greater than 3) in any sieve size shall not exceed 8 percent by weight, when determined in accordance with ASTM D 4791.

2.1.3 Open-Graded Mix Aggregate

The gradations in Table I represent the limits which shall determine the suitability of open-graded mix aggregate for use from the sources of supply. The aggregate, as finally selected, shall have a gradation within the limits designated in Table I and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be uniformly graded from coarse to fine.

TABLE I

OPEN-GRADED MIX AGGREGATE

Sieve Size	Percent by Weight Passing
19 mm	100
12.5 mm	54-76
9.5 mm	38-60
4.75 mm	10-20
2.36 mm	8-16
0.60 mm	4-10
0.075 mm	1-3

Table I is based on aggregates of uniform specific gravity; the percent passing various sieves may be changed by the Contracting Officer when

aggregates of varying specific gravities are used. Adjustments of percentages passing various sieves may be directed by the Contracting Officer when aggregates vary more than 0.2 in specific gravity.

2.1.4 Slurry Grout Sand

Slurry grout sand shall consist of clean, sound, durable, particles of processed silica sand that meet the requirements for wear and soundness specified for coarse aggregate. The sand shall contain no clay, silt, or other objectionable matter. The gradations in Table II represent the limits which shall determine the suitability of silica sand for use from the sources of supply.

TABLE II

FINE SAND FOR SLURRY GROUT

Sieve Size	Percent by Weight Passing
1.18 mm	100
0.600 mm	95-100
0.075 mm	0-2

The sand gradations shown are based on sand of uniform specific gravity, and the percentages passing the various sieves will be subject to appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

2.1.5 Filler (Fly Ash)

Fly ash shall have at least 95 percent by weight of material passing the O.075 mm sieve. Fly ash shall conform to ASTM C 618 Class F requirements.

2.2 BITUMINOUS MATERIAL

Bituminous material shall conform to the requirements of ASTM D 3381 and shall be of the viscosity grade AC-20 with an original penetration of 40 to 100.

2.3 CEMENT

The cement used in the slurry grout shall be portland cement conforming to ASTM C 150, Type II.

2.4 CROSS POLYMER RESIN

A cross polymer resin of styrene and butadiene, Prosalvia L7, shall be utilized as a plasticizing and strength producing agent. After mixing the resin into the slurry grout, the mixture shall have a viscosity which would allow it to flow from a Marsh Cone in accordance with Table III. A Marsh cone has dimensions of 155 mm base inside diameter, tapering 315 mm to a tip inside diameter of 10 mm . The 10 mm diameter neck shall have a length of 60 mm .

TABLE III

SLURRY GROUT VISCOSITY

Time Elapsed After Addition of PL7	Marsh Flow Cone Viscosity
0 to 30 minutes	8 to 10 seconds
After 30 minutes	9 to 11 seconds

2.5 CURING COMPOUND

Membrane-forming curing compound shall be white pigmented compounds conforming to COE CRD-C 300.

2.6 JOB MIX FORMULA FOR OPEN-GRADED ASPHALT AND SLURRY GROUT

2.6.1 Open Graded Asphalt Job Mix Formula

The Job Mix Formula (JMF) for the open graded bituminous mixture shall be furnished by the Contractor and approved by the Government. No payment will be made for mixtures produced prior to the approval of the JMF by the Contracting Officer.

2.6.1.1 Initial Laboratory Procedure

(1) Sample aggregates according to ASTM D 75 and asphalt cement according to ASTM D 140. An open-graded asphalt concrete mix design requires a minimum of 45 kg of each aggregate stockpile and 15 L of asphalt cement.

(2) Oven dry aggregate stockpile samples and conduct a sieve analysis (ASTM C 136) on each sample. Determine the combination of aggregate stockpiles that results in a gradation closest to the center of the limiting gradation band. This stockpile combination will become the blending formula for the open-graded asphalt concrete.

(3) Measure apparent specific gravity of aggregates (ASTM C 127 and ASTM C 128) from each stockpile used in the final gradation. Calculate apparent specific gravity of combined aggregates using the blending formula percentages. Measure specific gravity of asphalt cement (ASTM D 70).

(4) Estimate the optimum asphalt content using the following equation:

$$\text{Optimum asphalt content} = 8.61(0.21G + 5.4S + 7.2s + 135f)^{0.2} \div SG$$

where

SG = apparent specific gravity of the combined aggregates
G = percentage of material retained on the 4.75 mm sieve
S = percentage of material passing the 4.75 mm and retained on the 0.6 mm sieve
s = percentage of material passing the 0.6 mm .sieve and retained on the 0.075 mm sieve

f = percentage of material passing 0.075 mm sieve

(5) Round the calculated optimum asphalt content value to the nearest tenth of a percent. Use this asphalt content value along with two asphalt contents above this amount and two asphalt contents below this amount in the production of mix design samples. Use 0.5 percent above and below the optimum and 1.0 percent above and below the optimum as the four additional asphalt contents. Calculate maximum theoretical specific gravities for each of these five asphalt cement contents using ASTM D 2041.

2.6.1.2 Specimen Production

Using the five mix design asphalt contents, produce three 100 mm diameter Marshall specimens at each asphalt content according to ASTM D 1559, except as stated below. Use approximately 800 grams of combined aggregates following the previously determined aggregate blending formula for each specimen. Just before mixing, the temperature of the aggregates should be 145 ± 5°C and the asphalt cement should be 135 ± 5°C . With normal mixing procedures, the temperature of the asphalt mixture during compaction is 120 ± 5°C . Compact the open-graded asphalt concrete specimens with 25 blows from a 4.5 kg Marshall hand hammer on one side of each specimen. Allow the specimens to air cool for a minimum of 4 hours before carefully removing from molds.

2.6.1.3 Measuring voids total mix (VTM)

(1) Measure the VTM of each open-graded specimen using the following formula:

VTM = (1 - WTAIR /Volume * 1/SGT) * 100

where

WTAIR = dry weight of specimen in grams
Volume $=0.785(D)^2(H)$
D = diameter in cm
H = height in cm
SGT = maximum theoretical specific gravity

(2) Calculate the average VTM for each of the five asphalt cement contents. Select the optimum asphalt content as that which resulted in a VTM value closest to 30.0 percent. If no VTM averages are in the 30.0 percent range, then make adjustments to the aggregate gradation to achieve the proper void content. Optimum asphalt contents resulting in average VTM values in the 25 to 35 percent range are acceptable, but due to normal production and construction variations, the JMF shall be based on a mix design that provides a 28 to 32 percent VTM value is required. Typical optimum asphalt contents are between 3.5 and 4.5 percent.

2.6.1.4 Job-Mix Formula Submittal

(1) The open-graded asphalt concrete job-mix formula will consist of the following information:

(a) Percentage of each aggregate stockpile.
(b) Percentage passing each sieve size for the blended aggregate.

(c) Percentage of bitumen.
(d) Temperature of discharged asphalt mixture.
(e) Voids total mix percentage.

(2) The target temperature of the asphalt mixture when it is discharged from the mixing plant should be 125 ± 5°C . The contractor shall adjust the temperature depending on the ambient temperatures and the haul distance from the asphalt plant to the job site to meet the lay-down temperature.

2.6.2 Job Mix Formula for Slurry Grout

The Job-Mix Formula (JMF) for the slurry grout shall be furnished by the Contractor and approved by the Government. The slurry grout job mix formula shall be developed using the proportions given in Table V.

TABLE V

RESIN MODIFIED CEMENT SLURRY GROUT MIXTURE PROPORTIONS

Material	Percent by Weight
Silica Sand	16-20
Fly Ash	16-20
Water	22-26
Portland Cement	34-40
Cross Polymer Resin	2.5-3.5

Approximately 12 to 15 kg of mixed slurry grout will fill in one square meter (25 mm thickness) of open graded bituminous mixture with 25 to 35 percent voids total mix.

2.6.2.1 Initial Laboratory Procedure

(1) Minimum sample size is 23 kg for cement, sand, and fly ash; and is 4 L for resin additive.

(2) Using the grout material proportions specified in Table V, develop a matrix of initial job-mix formulas for laboratory viscosity testing. The goal of the grout mix design is to produce a material formulation, which results in a field Marsh Flow Cone viscosity of 8.0 to 10.0 seconds. The initial formulations shall ensure that a grout formulation can be produced with a Marsh viscosity no greater than the 10.0 seconds maximum. This is accomplished by testing grout formulations with relatively high w/c ratios and the maximum allowable amount of resin additive.

(3) The grout's w/c ratio shall be between 0.65 to 0.75, unless approved by the Contracting Officer Representative. Higher w/c ratios are sometimes necessary to produce grout with Marsh Flow viscosity less than the 10.0-second maximum value. Therefore, the focus of the initial grout viscosity tests is to determine the minimum W/C ratio that will produce a grout viscosity less than or equal to 10.0 seconds. The resin additive serves as a plasticizer which reduces grout viscosity while reducing the amount of water required.

(4) The standard laboratory grout batch size should be in the 4 to

5 kg range. Calculate the material batch weights based on the desired proportions. Multiple grout viscosity tests are facilitated by first blending the dry ingredients (cement, sand, fly ash) for each test sample and then adding the appropriate amount of water and resin additive during the mixing process. These dry ingredient batches should be kept in air-tight containers to prevent loss of material or contamination before mixing. Replicate two samples per blend for grout viscosity testing.

2.6.2.2 Mixing

(1) The equipment needed to effectively mix the resin grout includes a laboratory mixer equipped with a wire whip mixing attachment and approximately 10 L capacity mixing bowl, a calibrated set of weight scales, and various small containers to weigh and transfer mix water and resin additive.

(2) Place dry ingredients into mixing bowl and adjust the bowl height so that the wire whip is just off of or touching the bottom and the sides of the bowl. Begin mixing the dry ingredients at a slow speed and immediately add the appropriate amount of water. Once all of the water is added, speed up the mixer to a point where the grout is being thrown onto the sides of the mixing bowl. Mix the grout at this high speed for 5 minutes, then add the appropriate amount of resin additive. Mix the grout again at a high mixing speed for an additional 3 minutes before testing for Marsh Flow viscosity.

2.6.2.3 Viscosity Testing

(1) The equipment needed to measure grout viscosity includes a Marsh Flow Cone, a 1,000 mL glass or clear plastic graduated cylinder beaker, a 1,500 mL (approximately) empty beaker or bucket, and a stopwatch.

(2) Immediately after mixing the grout, transfer the grout from the mixing bowl to the empty beaker or bucket. Take note of any lumps of material or excess sand in the bottom of the mixing bowl. Excess lumps indicate inadequate mixing and render the grout useless for viscosity testing. Immediately fill the Marsh Flow Cone with about 1,100 mL of grout. A consistent head of grout in the flow cone is achieved for all viscosity tests by marking an 1,100 mL fill line inside the flow cone. The flow cone outlet is plugged by simply placing one's finger over the outlet opening. Immediately after the flow cone is filled to the 1,100 mL fill line, position the cone over the 1,000 mL graduated beaker. Release the grout opening and start the stopwatch timer simultaneously. Measure the time of flow for 1 L of grout from the flow cone to the nearest tenth of a second.

(3) Record each test sample's viscosity, averaging the two replicates for each blend. Adjust the grout mix proportions as needed with the following considerations:

(a) Any grout viscosity between 8.0 and 10.0 seconds is acceptable. It should be noted; however, that when field construction temperatures are expected to be comparatively high (greater than 32°C) and/or the open-graded asphalt concrete voids

are expected to be considerably low (less than 30 percent), then lower viscosity grouts will help to ensure easy grout application and full grout penetration. In most cases, these variables are unknown; therefore, it is prudent to select the grout formulation which has the lowest viscosity.

(b) Select a grout job-mix formula with water and resin additive contents below the maximum allowable limits to allow the Contracting Officer Representative to approve small additions of these ingredients in the field if necessary to meet viscosity requirements.

(c) Low w/c ratios shall be selected, within the viscosity criteria, to produce grout with higher strengths; reduce the chances for drying shrinkage cracking; and produce grout which is more consistent and better able to keep the sand in suspension during mixing and placement.

(d) When the sand is noted to settle out of solution during or immediately after mixing, the JMF shall be adjusted by reducing the amount of sand and increasing the amount of fly ash (both within the specified tolerances).

(e) If the viscosity requirements cannot be met, the Contractor shall change the source of materials. Typical problems to investigate include the following: grout sand which is too coarse, portland cement which is highly reactive during the early stages of the hydration process, fly ash with excess cementitious nature.

2.6.2.4 Job-Mix Formula Submittal

The grout job-mix formula will consist of the following information:

(1) Percentage (by weight) of each mixture ingredient rounded to the nearest tenth of a percent.

(2) Type and source of portland cement.

(3) Source of fly ash, silica sand, and resin additive.

(4) Marsh Flow Cone viscosity of job-mix-formula grout.

PART 3 EXECUTION

3.1 WEATHER LIMITATIONS

The bituminous mixture shall not be placed upon a wet surface, in rain, or when the surface temperature of the underlying course is less than l0 degrees C. Once the bituminous mixture has been placed, and if rain is imminent, protective materials consisting of rolled polyethylene sheeting at least 0.l mm thick of sufficient length and width to cover the mixture shall be placed. If the open graded bituminous mixture becomes saturated, the Contractor shall allow the pavement voids to thoroughly dry out prior to applying the slurry grout.

3.2 PREPARATION OF OPEN GRADED MIXTURES

Rates of feed of aggregates shall be regulated so that moisture content and

temperature of aggregates will be within tolerances specified. Aggregates and bitumen shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at time of mixing shall not exceed 135 degrees C. Temperature of aggregate in the mixer shall not exceed 150 degrees C when bitumen is added. Overheated and carbonized mixtures or mixtures that foam shall not be used.

3.3 WATER CONTENT OF AGGREGATES

Drying operations shall reduce the water content of mixture to less than 0.75 percent. Water content shall be determined in accordance with ASTM D 2216; weight of sample shall be at least 500 grams. The water content shall be reported as a percentage of the total mixture.

3.4 STORAGE OF MIXTURE

The open graded bituminous mixture shall not be stored for longer than one hour prior to hauling to the job site.

3.5 TRANSPORTATION OF MIXTURE

Transportation from the mixing plant to the job site shall be in trucks having tight, clean, smooth beds lightly coated with an approved releasing agent to prevent adhesion of mixture to truck bodies. Diesel fuel shall not be used as a releasing agent. Excessive release agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from the weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or have become wet will be rejected. Hauling over freshly placed material will not be permitted.

3.6 TEST SECTION

Prior to full production, and in the presence of the Contracting Officer Representative, the Contractor shall prepare and place a quantity of open graded bituminous mixture and slurry grout according to the JMF. The test section shall be a minimum of 30 meters long and 6 meters wide placed in one section and shall be of the same depth specified for the construction of the course which it represents. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section. The test section shall meet the requirements specified in paragraph ACCEPTABILITY OF WORK. If the test section should fail to meet these requirements, the necessary adjustments to the mix design, plant operation, and/or construction procedures shall be made. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications at the Contractor's expense. A representative for the resin manufacturer shall be on site during the test section construction and during the initial placement.

3.7 SURFACE PREPARATION OF UNDERLYING COURSE

Prior to placing of open graded bituminous mixture, the underlying course shall be cleaned of all foreign or objectionable matter with power brooms and hand brooms.

3.8 TACK COATING

Immediately before placing open-graded asphalt mix, contact surfaces of previously constructed pavement shall be sprayed with a coat of bituminous material as specified in Section 02748 BITUMINOUS AND PRIME TACK COAT.

3.9 PLACING OPEN GRADED BITUMINOUS MIXTURE

The mix shall be placed at a temperature of not less than 80 degrees C. Upon arrival, the mixture shall be spread to the full width (minimum 3 meters) by a bituminous paver. It shall be struck off in a uniform layer to a depth that, when the work is completed, will produce the required thickness indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the bituminous mat. Unless otherwise directed, placement of the mixture shall begin along the center line of a crowned pavement or along the highest side of a sloped cross-section. The mixture shall be placed in consecutive adjacent strips. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted by hand tools. The longitudinal joint in the RMP shall be offset from the longitudinal joint in the underlying asphalt pavement by at least 300 mm .

3.9.1 Rollers

Small (1.8 metric ton maximum) tandem steel wheel vibratory rollers shall be used to smooth over the surface of freshly placed open graded bituminous mixture. The vibratory unit shall be turned off during smoothing of the bituminous mixture. Rollers shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and weight of rollers shall be sufficient to roll the mixture to the voids total mix requirement of 25 to 35 percent while it is still in a workable condition. The use of equipment which causes excessive crushing of the aggregate will not be permitted.

3.9.2 Smoothing of Open Graded Bituminous Mixture

The open graded bituminous mixture shall be smoothed with one to three passes of the prescribed roller without vibration. The temperature of the freshly placed open graded bituminous mixture shall be low enough to prevent excessive shoving or cutting of the mat under the roller.

3.9.3 Protection of Ungrouted Pavement

The Contractor shall protect the ungrouted pavement and its appurtenances from traffic and against contamination from mud, dirt, wind blown debris, waterborne material, or any other contamination which could enter the void spaces of the open graded bituminous mixture before grout application. Protection against contamination shall be accomplished by keeping the construction site clean and free of such contaminants and by covering the ungrouted pavement with protective materials when directed by the Contracting Officer. Such protective materials shall consist of rolled polyethylene sheeting as described in paragraph WEATHER LIMITATIONS. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the pavement surface.

3.10 PREPARATION OF SLURRY GROUT

The slurry grout shall be mixed using a batch plant, portable mixer and/or ready-mix truck and according to mix proportions stated in the approved

JMF. The cross polymer resin shall be added to the mixture after all other ingredients have been thoroughly mixed. When using ready-mix trucks for transporting slurry grout, the grout mixture shall be thoroughly mixed at the job site immediately before application for a minimum of 10 minutes. Thorough mixing shall be accomplished by rotating the mixing drum at the maximum allowable revolutions per minute.

3.11 PLACING SLURRY GROUT

Temperature of the bituminous mixture shall be less than 38 degrees C before applying grout. Each batch of slurry grout shall be tested at the job site immediately before placement and shall be used in the finished product only if it meets the requirements specified in paragraph ACCEPTABILITY OF WORK. The slurry grout shall be spread over the bituminous mixture using a spreader or squeegees. The application of the slurry grout shall be sufficient to fill the internal voids of the open graded bituminous mixture. The grouting operation shall begin at the lowest side of the sloped cross-section and proceed from the low side to the high side. The practical limit for the surface slope of an RMP section is 2 percent. Pavement slopes up to 5 percent can be constructed, but excess hand work and grout overruns are to be expected at slopes greater than 2 percent. The slurry grout shall be placed in successive paving lanes with a maximum width of 6 meters . The use of strips of wood lumber or foamed rubber to separate each of the grouting lanes and the RMP from adjacent pavements is optional. The direction of the grouting operation shall be the same as used to pave the open graded bituminous mixture. The small (1.8 metric ton maximum) tandem steel wheel roller (vibratory mode) passing over the grout covered bituminous mixture shall be used to promote full penetration of the slurry grout into the void spaces.

3.12 JOINTS

3.12.1 Joints Between Successive Lanes of RMP

Joints between successive lanes of RMP shall be made ensuring a continuous bond between the paving lanes. All RMP joints shall have the same texture, density, and smoothness as other sections of the course.

3.12.2 Joints Between RMP and Adjacent Pavements

Joints between the RMP and any surrounding pavement surfaced with portland cement concrete shall be saw cut to the full thickness of the RMP layer and filled with a joint sealant material approved by the Contracting Officer.

3.13 CURING

The curing compound shall be applied to the finished pavement surface within 2 hours of the completed slurry grout application. The curing compound shall be applied by means of a pressurized spraying machine. Application of the curing compound shall be made uniformly in one or two coats with a total application rate of not more than 10 square meters per liter .

3.14 PROTECTION OF GROUTED PAVEMENT

The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents for a period of 21 days. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the

Contractor's expense. In order to properly protect the pavement against the effects of rain before the pavement is sufficiently hardened, the Contractor shall have available, at all times, materials for the protection of the edges and surfaces of the unhardened RMP. The protective materials and method of application shall be the same as previously described in paragraph WEATHER LIMITATIONS. When rain appears imminent, all paving operations shall stop, and all available personnel shall begin covering the surface of the hardened RMP with protective covering.

3.15 CONTRACTOR QUALITY CONTROL

3.15.1 General Quality Control Requirements

The Contractor shall develop an approved Quality Control Plan. Hot-mix asphalt for payment shall not be produced until the Quality Control Plan has been approved. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction

l. Surface Smoothness

3.15.2 Quality Control Testing

The Contractor shall perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, slurry grout viscosity, grade and smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

3.15.3 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per days production of open-graded asphalt mix, by one of the following methods: the extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the ASTM D 6307, or the nuclear

method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

3.15.4 Gradation

Aggregate gradations shall be determined a minimum of twice per day from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

3.15.5 Temperatures

Temperatures shall be checked at least four times per day, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.15.6 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per day in accordance with ASTM C 566.

3.15.7 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per lot in accordance with ASTM D 1461 or an approved alternate procedure.

3.15.8 Air Voids

Voids total mix shall be determined from random core samples taken from in-place open-graded asphalt mixture. Sample voids shall be calculated as outlined in the Job Mix Formula criteria. Voids shall be between 25 and 35 percent. Material not meeting the void criteria shall be removed and replaced at no additional cost to the Government.

3.15.9 Grade and Smoothness

The Contractor shall conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph ACCEPTABILITY OF WORK.

3.15.9.1 Grade

The final wearing surface of the pavement will be tested for conformance with specified plan grade requirements, before grout is applied. The grade will be determined by running lines of levels at intervals of 7.6 m , or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular area, the Contracting Officer will inform the Contractor in writing, of the results of the grade-conformance tests.

3.15.9.2 Smoothness

All testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer Representative. After the the slurry grout has sufficiently cured, but not later than 48 hours after placement, the surface of the pavement shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified in table VI. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 8 m or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lines less than 6.1 m and at the third points for lanes 6.1 m or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

3.15.10 Job-Mix-Formula

Routine testing for acceptability of work shall be performed by a Corps of Engineers certified commercial laboratory hired by the contractor and approved by the Contracting Officer. Additional tests required to determine acceptability of non-conforming material shall be performed by the Contractor at its own expense. The contractor shall use a Marsh Flow Cone for testing the viscosity of grout.

3.16 ACCEPTABILITY OF WORK

3.16.1 General

When a section of pavement fails to meet the specification requirements, that section shall be totally removed and replaced at the Contractor's expense. The Contracting Officer reserves the right to sample and test any area which appears to deviate from the specification requirements.

3.16.2 Field Sampling of RMP Materials

3.16.2.1 Open Graded Bituminous Mixture

Samples of open graded bituminous mixture shall be taken from loaded trucks for every 1,000 square meters of pavement, but not less than two samples for each day of paving for determining asphalt content, aggregate gradation, and laboratory compacted voids total mix. Laboratory specimens of open graded bituminous material shall be compacted in 101.6 mm (4 inch) diameter molds to a 50.8 mm (2 inch) thickness using 25 blows on one side from a Marshall hand hammer. Test results from the sampled open graded bituminous mixture shall be compared to the approved job-mix-formula and approved by the Contracting Officer for acceptance. The tolerances given in Table IV for sieve analysis, bitumen content, and temperature shall be applied to quality control test results on the open graded bituminous mixture as discharged from the mixing plant.

TABLE IV

JOB-MIX-FORMULA TOLERANCES

Material	Tolerance, Plus or Minus
Aggregate passing 4.75 mm or larger sieves	4 percent
Aggregate passing 2.36 and 0.60 mm sieves	3 percent
Aggregate passing 0.075 mm sieve	1 percent
Bitumen	0.20 percent
Temperature of discharge mix	10 degrees C
Voids Total Mix	2 percent

3.16.2.2 Slurry Grout

Each batch of slurry grout shall be tested for viscosity at the jobsite after thorough mixing and before application. Any batch of slurry grout failing to meet the specified viscosity shall be rejected and removed from the jobsite. Slurry grout with visible amounts of sand settling out of suspension during application shall be rejected and removed from the jobsite.

3.16.2.3 Core Samples

Random core samples shall be taken from the in-place open graded bituminous mixture before and after application of the slurry grout. The Contractor shall take at least two field core samples before grout application and two after grout application for every 1,000 square meters of finished RMP. Half of the core samples taken after grout application shall be taken from joints between successive grouting lanes. Field core samples shall be 102 or 152 mm (4 or 6 inch) diameter and extend the full depth of the RMP surface layer. The ungrouted core samples shall be tested for thickness. The grouted core samples shall be visually inspected for acceptable grout penetration. Acceptable grout penetration shall be through the full thickness of the RMP layer with a minimum of 90 percent of the visible void spaces filled with slurry grout. After testing, the Contractor shall turn over all cores to the Contracting Officer. Core holes in ungrouted RMP shall be filled with hot open graded bituminous material and leveled to match the surrounding pavement surface. Core holes in grouted RMP shall be filled within 24 hours from the time of coring with RMP material, low-shrinkage portland cement concrete material, or other approved patching material.

3.16.3 Thickness, Grade and Surface-Smoothness Requirements

Finished surface of RMP, when tested as specified below, shall conform to the thickness and grade specified and to surface smoothness requirements specified in Table VI. In areas where the thickness, grade or smoothness exceeds the tolerance, the Contractor shall remove the surface lift to full depth; the Contractor shall then replace the lift with open graded asphalt to meet specification requirements, at no additional cost to the Government. Diamond grinding may be used, after grout has cured, to remove high spots to meet grade or smoothness requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

TABLE VI

SURFACE-SMOOTHNESS TOLERANCES

Direction of Testing	Resin Modified Pavement Tolerance, mm
Longitudinal	6
Transverse	6

3.16.3.1 Thickness

The thickness of the RMP shall meet the requirements shown on the contract drawings. The measured thickness of the RMP shall not exceed the design thickness by more than 13 mm, or be deficient in thickness by more than 6 mm .

3.16.3.2 Surface Smoothness

Finished surfaces shall not deviate from testing edge of a 3.7 meter (12 foot) straightedge more than the tolerances shown for the respective pavement category in Table VI.

3.16.3.3 Surface Texture

The surface texture shall be uniform and free of excess cement grout. Finished surface shall have all grout removed below the top of the open-graded asphalt concrete.

3.16.3.4 Grade

The finished surface of pavement shall conform to the elevations and the cross sections shown and shall vary not more than 15 mm from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements.

-- End of Section --

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-02-R-0011

ATTACHMENT B

GEOTECHNICAL REPORT

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-02-R-0011

FORT HOOD, TEXAS
TACTICAL EQUIPMENT SHOP

FOUNDATION AND PAVEMENT DESIGN ANALYSIS

1. General. The purpose of this report is to provide subsurface information, and foundation and pavement design recommendations in support of the Request for Proposal, Tactical Equipment Shop at Fort Hood, Texas. The new Tactical Equipment Shop will provide approximately 5,142 GSM of space to house vehicle maintenance shops, maintenance bays, storage areas, and rest rooms. New building construction is anticipated to be structural steel framing, load and non-load bearing masonry walls, or a combination thereof. Support features include a Lubricant Storage Building, Sentry Building, concrete hardstand, privately-owned vehicle (POV) parking areas, service road, access drives, new utilities, and site improvements.

The project site is located within the 40000 Block of the western portion of the main cantonment. The parcel of land designated for improvement is directly north of the intersection of Tank Destroyer Boulevard and 80th Street, east of Motor Pool Road, and west of existing Building 40015. Existing grades within the area investigated vary from approximate elevations 289.25 meters to 295.00 meters (NGVD) trending in a northwest to southeast direction. At the time of this report, the building finish floor elevation had not been established.

2. Subsurface Investigation. Five (5) test holes were drilled at the project site in November 2001 by the U.S. Army Corps of Engineers, Fort Worth District. Borings 8A4C-5379 through 8A4C-5383 were drilled to determine subsurface conditions and to obtain representative soil and rock samples for laboratory testing. The test holes were advanced and samples recovered using 8- and 10-inch diameter short flight augers, a 4-inch diameter core barrel sampler, and 4- and 6-inch diameter rockbits. Samples recovered from the borings were sealed in airtight containers and taken to the laboratory of TEAM Consultants, Incorporated (Arlington, Texas)

for testing. The borings were drilled using a Failing 1500 truck-mounted drill rig and advanced to total depths of 8.38 meters, 9.45 meters, 10.82 meters, 12.65 meters, and 14.94 meters below existing grade at the time of the field investigation. Results of the field investigation are shown on Sheets LB1 and LB2, Logs of Borings and Boring Locations (Appendix A).

Groundwater conditions were monitored immediately upon completion of the test holes and after 18-hour, 32-hour, and 6-day observation periods. Static levels measured at those times are 2.74 meters, 5.33 meters, 8.05 meters, and 9.27 meters below existing grade. It should be noted, however, that groundwater conditions are relative to the time of drilling, annual precipitation, and drainage conditions at the site.

3. Subsurface Conditions.

a. General Geology. Fort Hood lies within the Central Texas Section of the Great Plains physiographic province. The topographic features of the area are those of a dissected plateau characterized by buttes and mesas. Approximately 48 kilometers southeast of Fort Hood, the dissected plateau topography gives way to the moderate or rolling relief of the Gulf Coastal Plain. The Balcones fault zone is, roughly, the dividing line of the two physiographic provinces. The uppermost primary stratum underlying Fort Hood is the Walnut Formation of the Comanche Series, Cretaceous age. The Walnut Formation is composed of gray-black, calcareous clay shales alternating with beds of chalky, nodular limestone and shell conglomerates. The entire Walnut Formation was not penetrated by borings drilled at the site.

Overburden soils within the area vary from a few millimeters to greater than 9 meters in thickness, and consist of clays of low to high plasticity, clayey gravels and/or clay choked limestone nodules. The overburden soils are residual soils derived from the underlying parent

material.

b. Site Conditions. Currently, the project site is a vacant parcel that is void of any major obstacles to construction. The western half of the site is covered with a veneer of base-type materials, except along the periphery where there is a modest amount of grass cover. Along the eastern side of the site, there is an existing asphalt service road and concrete loading ramps. In the area north of the loading ramps, an asphalt veneer covers concrete pavement. Within the area east of the loading ramps, there are buried concrete piers, footings, and foundation walls. Scattered across the site are concrete pavements and concrete fence post foundations. Based on information from Central Texas Area Office personnel, the estimated quantity of buried concrete structures is 150 cubic meters.

Overburden soils encountered during the field investigation are predominantly fill materials consisting of low to high plasticity clays (CL and CH), silty sands (SM), and clayey sandy gravels. The interbedded deposits vary in thickness from a knife-edge to around 1 meter. Physically, the fill materials are fine to coarse grained, white, brown, and yellow-brown, and have a medium to dense consistency.

Beneath the overburden materials are formations of shale/marl and limestone that are present to the total depth investigated, 14.94 meters. The initial primary feature is shale/marl that has been weathered to a soft/stiff clay consistency. The shale/marl is yellow-brown and light gray, gravelly, and fossiliferous. Thickness of the highly weathered primary varies from approximately 50 centimeters to 1.60 meters between test holes. The underlying primary feature is a formation of weathered shale/marl that is present to depths ranging from 7.32 to 10.47 meters below existing grade. The shale/marl is yellow-brown and light gray with some strong brown, soft to moderately hard (Rock Classification), massive, fractured, jointed, and

slickensided. Interbedded within this formation are hard limestone seams (Rock Classification) and dense zones of oyster shells. Weathering within the shale/marl was measured in borings 8A4C-5379, 8A4C-5380, and 3ST-5381 to depths of 7.47 meters, 10.49 meters, and 9.15 meters, respectively. The unweathered shale/marl has similar physical characteristics as the weathered formation, except it is dark gray.

It should be noted that a limestone primary material was encountered below the weathered shale/marl in borings 8A4C-5382 and 8A4C-5383. The limestone is weather stained white and yellow-brown, moderately hard to hard (Rock Classification), argillaceous, massive, jointed, and contains soft shale seams and dense zones of oyster shells. The dark gray, unweathered formation of the limestone was penetrated at a depth of 14.81 meters within boring 8A4C-5383.

Subsurface conditions representative of the project site are shown on the boring logs, Sheet LB2. The legend on the individual boring logs show overburden materials as classified in the laboratory using procedures presented in ASTM D 2488. It should be noted that the actual interface between material types may be far more gradual or abrupt than presented; therefore, actual subsurface conditions in areas not sampled may differ from those predicted. The nature and extent of variations across the site may not become evident until construction commences, and the actual construction process may alter subsurface conditions as well. If variations become evident at the time of construction, CESWF-EC-DG should be contacted to determine if the recommendations presented in this report need to be reevaluated.

4. Laboratory Testing. Representative soil and rock samples recovered from the test holes were subjected to laboratory testing for identification, moisture content, grain-size distribution, Atterberg limits, dry density, and strength. The accumulative test results are tabulated and

presented in English units in Appendix C. Results of identification and moisture content testing are shown on the individual boring logs, Appendix A.

The laboratory test results are also presented graphically in Appendix B as follows: Plasticity characteristics are shown on Plate 1, Plasticity Chart. Moisture content values of representative samples are shown with respect to depth on Plate 2. Atterberg limits test results are shown with respect to depth on Plate 3. Dry density values of representative undisturbed samples and their corresponding moisture contents are shown with respect to depth on Plate 4.

Shear strength characteristics of the shale/marl and limestone primary were analyzed in the laboratory using unconfined compression testing. Samples each of the weathered and unweathered primaries were selected for analysis. The ultimate compressive strengths and respective dry densities are presented below and in Appendix C at the end of this report.

Boring	Depth, m	δ, kg/m^3	Q_u, kPa	Material Type
8A4C-5379	2.19	1991	308	Weathered Shale/Marl
8A4C-5379	8.03	1930	771	Unweathered Shale/Marl
8A4C-5380	8.90	1777	107	Weathered Shale/Marl
8A4C-5380	10.67	2174	839	Unweathered Limestone
8A4C-5382	7.18	1773	154	Weathered Shale/Marl
8A4C-5382	9.81	2302	2225	Unweathered Limestone

5. Discussions. The following discussions are provided in support of the foundation and pavement design recommendations made for the proposed Tactical Equipment Shop.

a. Soil Activity Considerations. The site for the proposed Tactical Equipment Shop is characterized by overburden features consisting of sandy, clayey, and gravelly fill materials that are underlain by a highly weathered shale/marl. Thicknesses of these deposits vary from approximately 76 centimeters to 1.83 meters across the site. Moisture content test results indicate that the in situ materials are moisture deficient to an approximate depth of 1 meter.

Within the active zone, liquid limits range between 27 and 54 percent, plastic limits vary from 16 to 18 percent (PI = 9% to 37%), and natural moisture contents vary between 3 and 14 percent.

Based on the plasticity characteristics of the near surface in situ materials and the low moisture contents measured in the laboratory, post construction volumetric changes within the active subgrade will be significant during periods of seasonal moisture fluctuations. Atterberg limits and moisture content test results indicate that the upper 1 meter of in situ materials are the most active; therefore, these soils should be removed and replaced with compacted nonexpansive backfill material. In doing so, the magnitude of post construction soil movements will be limited to 25 millimeters or less, which is considered acceptable.

b. Foundation Design Considerations. Based on subsurface conditions at the project site, the Tactical Equipment Shop should be founded on a reinforced concrete straight-shaft drilled pier foundation. Drilled pier foundations are commonly used in the Fort Hood area because of the proximity of competent bearing materials to ground surface, and the satisfactory performance history associated with this foundation system. At this particular site, the shear strength of the primary increases significantly at depths in excess of 7.6 meters below existing grade, which can be attributed to the presence of more hard limestone seams within the primary. To this end, straight-shaft drilled piers should be founded at a minimum depth of 8 meters below existing grade. Founding piers at this depth will ensure that the structural load is transferred to the high shear strength primary material. Based on laboratory shear strength test results and a factor of safety equal to 3, an allowable end bearing capacity of 955 kPa (net) should not be exceeded when sizing the pier shafts. Designing the piers for this bearing

allowable will ensure that post construction movements in the form of settlement will be negligible.

The effects of skin friction can be considered in the design of the pier foundation to increase the load-carrying capacity of individual piers. For this phase of design, the effective embedment length (L_{eff}) starts 2 meters below existing grade and extends to within one shaft diameter of the final bearing depth. Based on laboratory shear strength test results and a factor of safety equal to 2, an allowable side shear value of 35 kPa can be utilized when sizing the piers. It should be noted that the aforementioned side shear value and effective embedment length can be used to analyze the foundation for both gravity load and lateral load considerations.

Straight-shaft drilled piers must contain a sufficient amount of reinforcing steel to resist the tensile stresses that develop within the pier concrete when the foundation is subjected to uplift forces. Based on analyses performed, the piers should contain a minimum of 1 percent reinforcing steel.

c. Floor Slab System(s) and Subgrade Preparation Requirements. Ground-level floor slabs within the Tactical Equipment Shop can be placed on-grade, except in deformation sensitive areas where ceramic tile flooring will be used. Soil-supported floor slabs should be isolated from any portion of the building structure and foundation using felt isolation joints. Transitional areas, such as door openings, should be articulated to prevent offsets from occurring. Floor slabs within deformation sensitive areas (rest rooms) should be structurally-supported to compensate for as much as 25 millimeters of long-term differential movement. Historically, this amount of movement has caused ceramic floor tile to crack.

Subgrade preparation to allow for slab-on-grade construction will depend on whether the building pad is built on a cut or fill section. For fill conditions, subgrade preparation should consist of removing at least 1 meter of existing materials and replacing with compacted nonexpansive backfill material. Any additional fill required to reach the final subgrade elevation below the building floor slab should be nonexpansive material as well. All fill and backfill should be placed in controlled lifts not exceeding 205 millimeters in loose thickness and compacted to the specified density to limit the magnitude of long-term consolidation within the fill section.

If the building pad is built on a cut section, subgrade preparation should consist of removing all existing materials to a depth that allows for a minimum of 1 meter of compacted nonexpansive material to be placed below the building floor slab. The exposed subgrade after excavation operations should be scarified, moistened, manipulated, and recompacted prior to the placement of fill materials. The nonexpansive fill should be placed in controlled lifts not exceeding 205 millimeters in loose thickness and compacted to the specified density.

d. Pavement Design Considerations. The pavement designs presented in this report are based on criteria contained in *TM 5-822-5/AFM 88-7, Chapter 1, TM 5-822-2/AFM 88-7, Chapter 5, TM 5-809-12/AFM 88-3, Chapter 15, TM 5-822-12*, design curves for a Heavy Equipment Transport (HET), and engineering judgment.

(1) Traffic Types and Conditions. Seven (7) pavement structures were analyzed and designed for this project; namely, an asphalt parking area and a concrete hardstand, access drives, an apron in front vehicle bays, floor slabs within vehicle bays, and an apron in front of trash dumpster pad(s). The final pavement section considered is a gravel strip around the hardstand. Types of vehicles expected to occupy the pavements are light- to heavy-duty

military tactical vehicles, M1 Tanks, passenger cars and trucks, two- and three-axle trucks, and fire/emergency medical vehicles. Based on criteria contained in the aforementioned Technical Manuals, the following traffic conditions were assigned:

Pavement Structure	Traffic Category/Condition	Street Class	Design Index
Hardstand	1030-kN HET	10,000 passes	9
Access Drives	1030-kN HET	10,000 passes	9
Aprons (Vehicle Bays)	VII(1/day)	Class E	6
Apron (Trash)	IVA	Class E	4
Bldg. Floor Slabs	222-kN Axle Load	10,000 passes	N.A.
POV Parking Area	II	Class E	2
Gravel Strip	IV	Class G	2

(2) Pavement Design Parameters. California Bearing Ratio (CBR) and plate bearing tests were not performed for this project due to the availability of historical pavement design data. In the past, the clayey subgrade indicative of Fort Hood has been assigned CBR values ranging from 4 to 6 percent when compacted to 90 percent of laboratory maximum density. Previously conducted plate-bearing tests indicate that a modulus of subgrade reaction on the order of 27.1 kPa/mm to 40.7 kPa/mm can be assigned to the in situ soils when compacted to 95 percent of laboratory maximum density.

Empirical relationships between laboratory and field test results have shown that strength characteristics of the raw subgrade are a function of the plasticity level of the soil. Typically, soils with high plasticity indexes have low load-carrying capabilities. To this end, comparisons were made between the plasticity levels measured from representative samples collected at the project site and values measured from historical CBR and plate bearing tests. Based on comparisons made and engineering judgment, a design CBR value of 4 percent and a

modulus of subgrade reaction of 33.9 kPa/mm were assigned to the raw subgrade when compacted to 90 percent of laboratory maximum density (ASTM D 1557).

(3) Lime Stabilization. The plasticity levels of the near surface in situ materials suggest that these soils will have a moderate expansion potential when subjected to changing moisture conditions. Lime stabilizing the active subgrade can be performed to improve the soil's strength and performance characteristics; however, the use of an aggregate base course material will be used as an alternative. In the past, base-type materials have been used as a substitute and the pavement structures have performed well. Because of the availability of base course materials in the Fort Hood area, their use for this project will reduce the in-place cost of the pavement structures.

(4) Material Sources. Material sources in central Texas are capable of producing a high quality crushed aggregate for concrete mixes to meet strength requirements. Therefore, a concrete flexural strength of 4.48 MPa at 28 days was considered in the design of rigid pavements. To date, Alkali/Silica Reaction with Portland Cement Concrete has never been a problem when using local aggregate sources.

6. Recommendations. The following foundation and pavement design recommendations are based on results of the field investigation, laboratory testing, and engineering studies.

a. Foundation Design Recommendations.

(1) Foundation System. The proposed Tactical Equipment Shop should be supported on reinforced concrete straight-shaft drilled piers. The piers should be founded at least 8 meters below existing grade. The bearing material at this depth is an interbedded, yellow-brown and gray shale/marl with limestone seams. An allowable end bearing capacity of 955 kPa (net) should not be exceeded when sizing the pier shafts. The bearing allowable can

be increased for wind load considerations. Additionally, straight-shaft drilled piers can be sized for an allowable side shear value of 35 kPa (net) for that portion of the pier shaft embedded within the shale/marl primary. For this design condition, the effective length (L_{eff}) starts 2 meters below existing grade and extends to within one shaft diameter of the final bearing depth. Individual piers can be extended if additional load-carrying capacity in side shear is required. Based on structural requirements, the load used to size the piers should consist of full dead load plus that portion of the live load that acts more or less continuously, usually 50 percent. ***If the piers are designed for both end bearing and skin friction, final bearing elevations must be shown on the contract drawings to aid construction personnel***.

All pier shafts should be a minimum of 457 millimeters in diameter to facilitate clean out and inspection of the pier holes during construction. A minimum of 1 percent reinforcing steel should be placed in each pier shaft, based on the cross-sectional area of the pier. A clear distance of at least two pier diameters should be maintained between individual piers. The larger size should be used for this condition when shaft sizes differ. A minimum 150-millimeter void should be maintained beneath all grade beams, and the void area should be protected with concrete retainer blocks as shown in the latest edition of the SWD-AEIM. **The bottom of all grade beams shall be formed with plywood to provide the 150-millimeter void.**

The contractor shall have temporary steel casing and pumps at the job site prior to construction of drilled piers. Groundwater should be anticipated during drilling operations; therefore, the above information should be provided in the contract documents as foundation notes. ***Final pier depths shall be determined in the field by the Contracting Officer's representative.***

Drilling equipment should be of suitable type and of sufficient size to satisfactorily perform the required drilling for the soil conditions identified. To this end, all drill rigs shall have minimum torque and crowd capacities of 67,800 N-m and 40,680 N-m, respectively.

The above criteria for drilled pier construction should be included in guide specification CEGS-02466 DRILLED FOUNDATION CAISSONS.

(2) Ground-Level Floor Slab System(s).

(a) Slab-On-Grade. Slab-on-grade construction can be used within the Tactical Equipment Shop, except in deformation sensitive areas (rest rooms) where ceramic floor tiles will be used. Soil-supported floor slabs should be isolated from any portion of the foundation or building structure using a minimum 1.46 kg/m^2 felt isolation joint. In doing so, the building structure-floor slab interface should be designed to accept vertical movements so that the operation of the facility will not be affected. This will result in the best performance. Transitional areas, such as door openings, can be doweled to prevent offsets from occurring. In these areas, the slab should bear on the grade beam to create a single joint at one face of the grade beam. Slab edges should extend to the outside face of the grade beam at exterior door locations. A polyethylene vapor barrier (6-mil) and a minimum 150-millimeter capillary water barrier should be provided beneath floor slabs supported on-grade.

(b) Structurally-Supported. Ground-level floor slabs in deformation sensitive areas (rest rooms) should be structurally-supported to compensate for the active subgrade. A minimum 150-millimeter void should be provided beneath the supported floor slab system. The designer should also consider articulating high impact areas such as stoops, porches, approaches, etc. to prevent offsets from occurring.

(3) Subgrade Preparation and Fill Requirements. Subgrade preparation and fill

requirements will depend on whether the building pad is constructed on a cut or fill section. The following guidance is provided for each condition:

(a) Fill Section. Subgrade preparation should consist of removing a minimum of 1 meter of existing materials and replacing with compacted nonexpansive backfill material. Any additional fill required to reach the final subgrade elevation below the building floor slab should be nonexpansive material as well. The upper 150 millimeters of existing subgrade exposed after excavation operations should be scarified, moistened, aerated, and recompacted to the same density as required for nonexpansive fill. Nonexpansive fill should be placed in controlled lifts not exceeding 205 millimeters in loose thickness and compacted to at least 92 percent of laboratory maximum density as determined in accordance with ASTM D 1557.

(b) Cut Section. Subgrade preparation should consist of removing all existing materials to a depth that allows for a minimum of one (1) meter of compacted nonexpansive fill to be placed below the building floor slab. The upper 150 millimeters of existing materials exposed after excavation operations should be scarified, moistened, manipulated, and recompacted prior to the placement of the nonexpansive backfill material. Nonexpansive fill should be placed in controlled lifts not exceeding 205 millimeters in loose thickness and compacted to at least 92 percent of laboratory maximum density as determined in accordance with ASTM D 1557.

(c) Material Testing Requirements. Testing shall be the responsibility of the contractor to ensure that the subgrade, fill, and backfill materials are properly compacted. To this end, the following frequencies of testing shall be included in the contract as a minimum:

- In-place density of the subgrade, fills, and backfills shall be performed for every 250 square meters per lift in accordance with ASTM D 1556 or ASTM D 2922.

- Optimum Moisture and Laboratory Maximum Density of nonexpansive fill and backfill shall be performed for every 385 cubic meters or when any change in material occurs.

(4) Small Support-Type Structures. The proposed Lubricant Storage Building and Sentry Building can be founded on reinforced concrete slabs-on-grade with turned-down edge beams. The turned-down edge beam should extend a minimum of 305 millimeters below outside finished grade and should be sized for a safe bearing pressure of 96 kPa (net). An interior stiffener beam should be added when the distance between exterior beams exceeds 4.5 meters. Subgrade preparation should consist of providing a minimum of 610 millimeters of compacted nonexpansive fill below the soil-supported slab.

(5) Below-Grade Structures. The following information is provided for the design of all below-grade structures. All structures shall be designed using an at-rest lateral earth pressure coefficient of (k_o) 0.7, an angle of internal friction (ϕ) equal to 28^o, an allowable bearing capacity of 96 kPa, and a cohesion value (c) of 4.8 kPa. The backfill material should be assumed to have a moist unit weight of 2000 kg/m^3 and all backfill should be nonexpansive material.

(6) Drainage. Proper drainage is an important design consideration to ensure satisfactory long-term foundation performance. Exterior grading adjacent to the building should be sloped away from the structure a minimum of 5 percent for the first 3 meters. Runoff from the roof should be adequately discharged away from foundation edges. In no case should water be allowed to pond adjacent to or beneath the building, both during and after construction.

(7) Foundation Material Definitions.

(a) Satisfactory Materials. Satisfactory Materials include materials classified in ASTM D 2487 as GW, GM, GC, GP, SW, SM, SP, SC, CL, and CH and shall be free of trash, debris, roots, or other organic matter, or stones larger than 76 millimeters in any dimension.

(b) Unsatisfactory Materials. Unsatisfactory Materials include materials classified in ASTM D 2487 as Pt, OH, OL, ML, MH and any other materials not defined as satisfactory.

(c) Nonexpansive Soils. Nonexpansive Soils shall meet the requirements of Texas Department of Transportation Standard Specification for base course, Item 247, Type A, Grade 1 or 2.

(d) Cohesionless and Cohesive Materials. Cohesionless Materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive Materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

(e) Capillary Water Barrier. Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 38 millimeters and no more than 2 percent by weight shall pass the 4.75-millimeter (No. 4) size sieve.

The above material definitions, subgrade preparation procedures, and material testing requirements should be presented in guide specification CEGS-02315 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

b. Pavement Design Recommendations. The pavement designs presented hereinafter

are based on criteria contained in *TM 5-822-5/AFM 88-7, Chapter 1, TM 5-822-2/AFM 88-7, Chapter 5, TM 5-809-12/AFM 88-3, Chapter 15, TM 5-822-12*, design curves for a Heavy Equipment Transport (HET), and engineering judgment.

(1) Rigid Pavements. The following rigid pavement sections are recommended for the vehicle hardstand, access drives, aprons in front of vehicle bays and trash dumpster pads, and the building floor slab within the vehicle maintenance bays. For the rigid pavement designs, a modulus of subgrade reaction equal to 33.9 kPa/mm and a concrete flexural strength of 4.48 Mpa at 28 days were considered, unless noted otherwise.

(a) Hardstand and Access Drives. Design is based on a 1030-kN HET making 10,000 passes over 20 years (DI=9).

230mm Portland Cement Concrete (nonreinforced)

150mm Aggregate Base Course compacted to at least 95 percent of laboratory maximum density (ASTM D 1557)

150mm Raw Subgrade compacted to at least 90 percent of laboratory maximum density (ASTM D 1557)

(Am #1) Optional Resin Modified Pavement for Hardstand. The Contractor has the option of using the Resin Modified Pavement (RMP) structure presented below for the hardstand. The design considers the same design vehicle listed above and a CBR value of 4 percent for the raw subgrade when compacted to 90 percent of laboratory maximum density (ASTM D 1557). RMP shall conform to the requirements of Guide Specification CEGS-02746, has been included.

FORT HOOD, TEXAS
TACTICAL EQUIPMENT SHOP

50mm Resin Modified Pavement

50mm Hot-Mix Intermediate Course

205mm Aggregate Base Course compacted to at least 100 percent of laboratory maximum density (ASTM D 1557)

205mm Aggregate Base Course compacted to at least 100 percent of laboratory maximum density (ASTM D 1557)

150mm Aggregate Base Course compacted to at least 95 percent of laboratory maximum density (ASTM D 1557)

150mm Raw Subgrade compacted to at least 90 percent of laboratory maximum density (ASTM D 1557)

(b) Aprons at Vehicle Bays. Design is based on Category VII Traffic making 1 pass/day.

165mm Portland Cement Concrete reinforced with No. 13 bars (metric) spaced 406 millimeters o.c.e.w.

150mm Aggregate Base Course compacted to at least 95 percent of laboratory maximum density (ASTM D 1557)

150mm Raw Subgrade compacted to at least 90 percent of laboratory maximum density (ASTM D 1557)

(c) Apron(s) in front of Trash Dumpster Pads. The following pavement section is recommended for a minimum distance of 4.57 meters in front of trash dumpster pads. The design is based on Category IVA Traffic and a Class F Street (DI=4).

150mm Portland Cement Concrete reinforced with No. 13 bars (metric) spaced 406 millimeters o.c.e.w.

150mm Aggregate Base Course compacted to at least 95 percent of laboratory maximum density (ASTM D 1557)

150mm Raw Subgrade compacted to at least 90 percent of laboratory maximum density (ASTM D 1557)

Reinforcement for odd-shaped slabs, joint design, joint spacing, and other details should be in accordance with the latest edition of the SWD-AEIM and TM 5-822-5, where applicable. The reinforcement bars should be placed a minimum of 38 millimeters clear distance from the surface of the pavement.

(d) Floor Slab within Vehicle Bays. The following pavement section is based on a 222-kN axle load vehicle making 10,000 passes over 20 years, an effective modulus of subgrade reaction equal to 54.3 kPa/mm (upgraded due to nonexpansive fill), and a concrete flexural strength of 4.14 MPa at 28 days. The vehicular floor slab should have a minimum thickness of 150 millimeters and reinforced with No. 13 bars (metric) spaced 305 millimeters on-center and in each direction. Subgrade preparation below the floor slab should be in accordance with the Foundation Design Recommendations presented in this report.

The design of the vehicular floor slab supported on-grade is based upon vehicle-imposed loads only, without regard for stresses caused by stationary live loads and/or other loading conditions.

(2) Flexible Pavement. The following pavement section is recommended for the privately-owned vehicle parking area(s). The design is based on Category II Traffic, Class E Street (DI=2), and a CBR value of 4 percent for the raw subgrade when compacted to 90 percent of laboratory maximum density.

38mm Hot-Mix Surface Course

180mm Aggregate Base Course compacted to at least 100 percent of laboratory maximum density (ASTM D 1557)

150mm Aggregate Base Course compacted to at least 95 percent of laboratory maximum density (ASTM D 1557)

150mm Raw Subgrade compacted to at least 90 percent of laboratory maximum density (ASTM D 1557)

(3) Gravel Perimeter Strip. The following design is based on Category IV Traffic, Class G Street (DI=2), and a CBR value of 4 percent for the raw subgrade when compacted to 90 percent of laboratory maximum density.

150mm Aggregate Base Course compacted to at least 100 percent of laboratory maximum density (ASTM D 1557)

100mm Aggregate Base Course compacted to at least 95 percent of laboratory maximum density (ASTM D 1557)

150mm Raw Subgrade compacted to at least 90 percent of laboratory maximum density (ASTM D 1557)

The following note should be incorporated as part of the pavement details shown on the contract drawings.

"The moisture content shall be at least 1 percent above optimum during compaction of the raw subgrade."

(4) Pavement Material Definitions.

(a) Hot-Mix Surface Course. Aggregates and asphaltic materials shall conform to the requirements of the Texas Department of Transportation, Standard Specifications for Construction of Highways, Streets and Bridges, (TXDOT, Std Spec), Items 300 and 340. The paving mixture shall conform to the requirements for Type "D" (fine-graded

surface course) grading. Asphaltic material for the paving mixture should be asphaltic cement, viscosity grade AC-20. **Guide Specification *CEGS-02741 BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS* should be edited to present the above requirements.**

(b) Prime Coat and Tack Coat. Asphaltic material for the prime coat shall be cut-back asphalt, grade MC-30, conforming to the requirements of TXDOT, Std Spec, Item 300, "Asphalts, Oils, Emulsions." Prime coat should be applied to the surface of the aggregate base course. Asphaltic material for the tack coat shall be cut-back asphalt, grade RC-250, or emulsified asphalt, grade SS-1, conforming to the requirements of TXDOT, Std Spec, Item 300, "Asphalts, Oils, Emulsions." Tack coat should be applied to all surfaces that contact new asphalt pavement. **Guide Specification *CEGS-02748 BITUMINOUS TACK AND PRIME COATS* should be edited to present the above requirements.**

(c) Aggregate Base Course. Aggregates shall conform to the requirements of ***Guide Specification CEGS-02722 AGGREGATE BASE COURSE***. The gradation should conform to the requirements of TXDOT, Std Spec, Item 247, for Type "A", Grade 1 material.

(d) Raw Subgrade. The material shall conform to the requirements of ***Guide Specification CEGS-02300 RAW SUBGRADE***.

(e) Portland Cement Concrete. The material shall conform to the requirements of ***Guide Specification 02753 CONCRETE FOR HEAVY-DUTY PAVEMENTS***. The maximum nominal size aggregate shall be 38 millimeters and the mixture shall be designed to attain a flexural strength of 4.48 MPa at 28 days.

(5) Vehicular Pavement Material Testing Requirements. Testing shall be the

responsibility of the contractor to ensure that the subgrade, aggregate base course, hot-mix surface course, and Portland cement concrete are properly constructed. To this end, the following testing requirements shall be included in the contract specifications as a minimum:

- In-place density testing of the subgrade and aggregate base course shall be performed, at a minimum, every 500 square meters per lift in accordance with ASTM D 1556 and ASTM D 2922. ASTM D 1556 shall be used as a check at least once per lift for each 2500 square meters of completed subgrade and aggregate base course.

- Before starting work, at least one sample of aggregate base course material shall be tested in accordance with ASTM C 136. After the initial test, a minimum of one sieve analysis (ASTM C 136 and ASTM D 422) shall be performed for each 1000 metric tons of aggregate base course placed, with a minimum of one analysis performed for each day's run until the course is completed. One liquid limit and plasticity index shall be performed for each sieve analysis per ASTM D 4318

- Wear tests shall be performed in accordance with ASTM C 131. A minimum of one test per aggregate base course material source shall be run.

- Thickness of the aggregate base course shall be measured for each 500 square meters of material placed. Compacted thickness of the aggregate base course shall be as presented in this report and the completed section shall be within 13 millimeters of the thickness presented.

- Hot Bin gradations for the asphalt wearing course shall be tested in accordance with ASTM C 136 and ASTM C 117. A minimum of one test shall be conducted. Marshall specimens shall be taken in accordance with CRD-C 652-95. At least two sets of specimens shall be taken. Asphalt extractions shall be performed in accordance with ASTM D 2172, Method A or B. At least one asphalt extraction shall be conducted. Field density tests shall be conducted in accordance with CRD-C 650-95. One test shall be conducted for each 250 square meters of pavement placed. The mat density shall be 97 to 100 percent and the joint density shall be 95 to 100 percent of the density obtained from laboratory-compacted specimens. Thickness measurements shall be taken at a minimum of one measurement for each 836 square meters of pavement placed.

- The Job Mix Formula for the bituminous mixture shall be furnished to the Contraction Officer for approval. The formula will indicate the percentage of each stockpile and mineral filler, the percentage of each size aggregate, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. The Contractor shall file with the Contracting

Officer certified delivery tickets for all aggregates and bituminous materials actually used in construction. The finished mixture shall meet the requirements described below and when tested in accordance with CRD-C 649-95. All samples will be compacted with 50 blows of specified hammer on each side of the sample.

Stability (minimum) – 2200 Newtons
Flow (maximum), 25/100-mm units – 20
Voids total mix – 3% to 5% (nonabsorptive); 2% to 4% (absorptive)
Voids filled with bitumen – 75% to 85% (nonabsorptive); 80% to 90% (absorptive)

- The contractor shall be responsible for the development of the mixture proportion study for cementitious materials and chemical admixtures. The concrete mix design shall include a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of concrete at least 60 days prior to commencing concrete operations. Trial design batches, mixture proportioning studies, and testing requirements shall be the responsibility of the Contractor. Strength requirements shall be based on flexural strength. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1, modified as necessary to accommodate flexural strength. The maximum water-cementitious material ratio is 0.45. Coarse and fine aggregates shall have a satisfactory service record of at least 5 years successful service in three paving projects, or if a new source is used, shall meet the requirements when tested for resistance to freezing and thawing. Coarse and fine aggregates not having a satisfactory demonstrable service record shall have a durability factor of 50 when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114 (Test Method for Soundness of Aggregates by Freezing and Thawing of Concrete Specimens).

- At least 10 days and not more than 60 days prior to construction of the concrete pavement, a test section shall be constructed. The test section shall consist of one paving lane at least 130 meters long. The test section shall contain one transverse construction joint.

- Smoothness measurements shall be taken in successive positions parallel to the pavement (flexible and rigid) centerline with a 3.66-meter straightedge. Measurements shall be taken perpendicular to the pavement (flexible and rigid) centerline at 4.5-meter intervals. Surface smoothness shall not exceed 9.5 millimeters.

References:

- TEAM Consultants, Incorporated Report No. 012065C
- TM 5-818-1/AFM 88-3, Chapter 7 – Soils and Geology Procedures for Foundation Design

of Building and Other Structures

- TM 5-818-7 – Foundation in Expansive Soils
- TM 5-822-5/AFM 88-7, Chapter 1 – Pavement Design for Roads, Streets, Walks, and Open Storage Areas
- TM 5-822-2/AFM 88-7, Chapter 5 – General Provisions and Geometric Design For Roads, Streets, Walks, and Open Storage Areas
- TM 5-809-12/AFM 88-3, Chapter 15 – Concrete Floor Slabs On Grade Subjected to Heavy Loads
- TM 5-822-12 - Design of Aggregate Surfaced Roads and Airfields
- Rigid Pavement Design Curve for the Heavy Equipment Transporter (HET)
- Texas Department of Transportation - Standard Specifications For Construction of Highways, Streets and Bridges
- SWD-AEIM Architectural-Engineering Manual
- CEGS Guide Specifications For Construction

FORT WORTH DISTRICT
FEBRUARY 2002

APPENDIX A

APPENDIX B

TACTICAL EQUIPMENT SHOP
PLASTICITY CHART

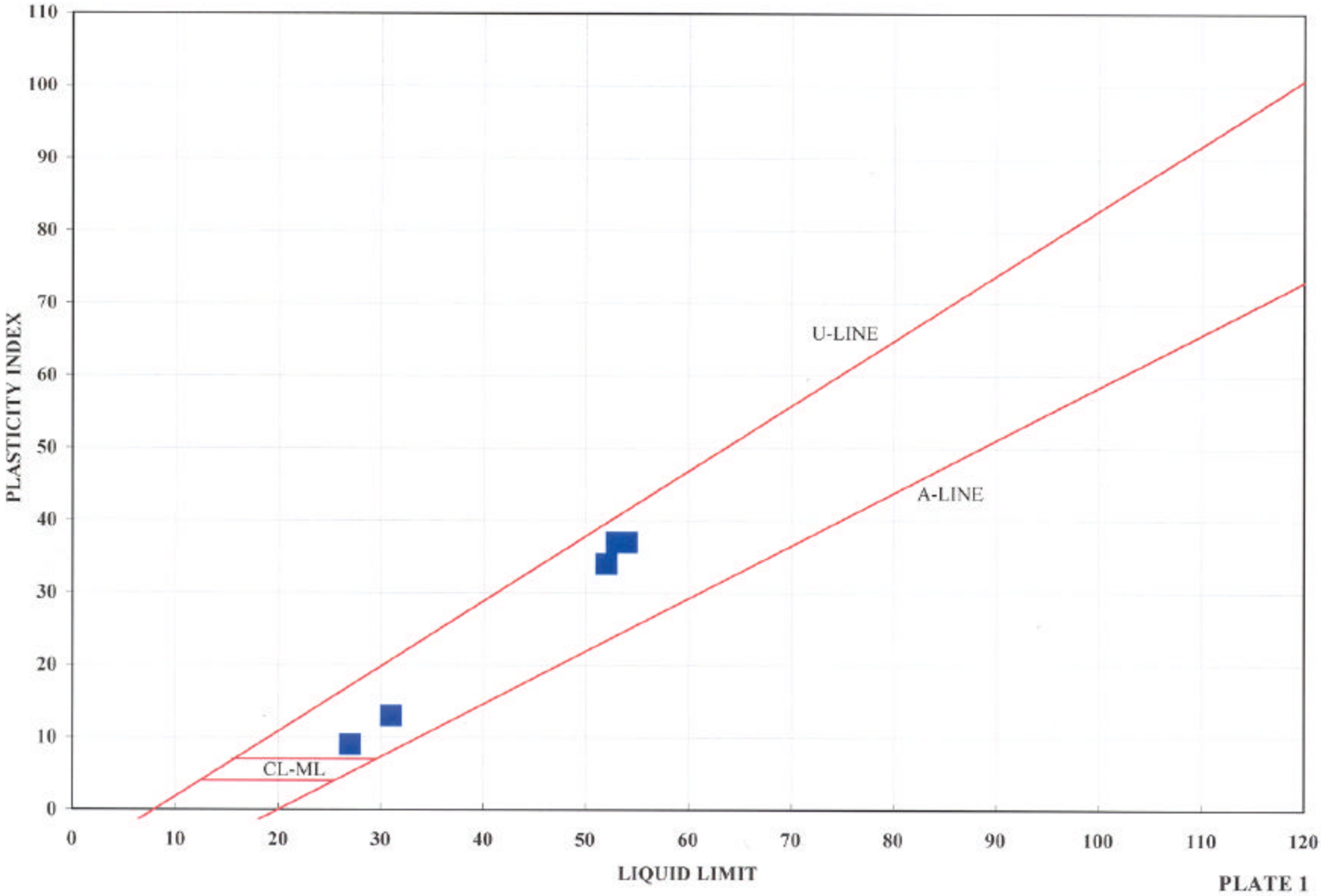

PLATE 1

TACTICAL EQUIPMENT SHOP
MOISTURE COTENT VS DEPTH

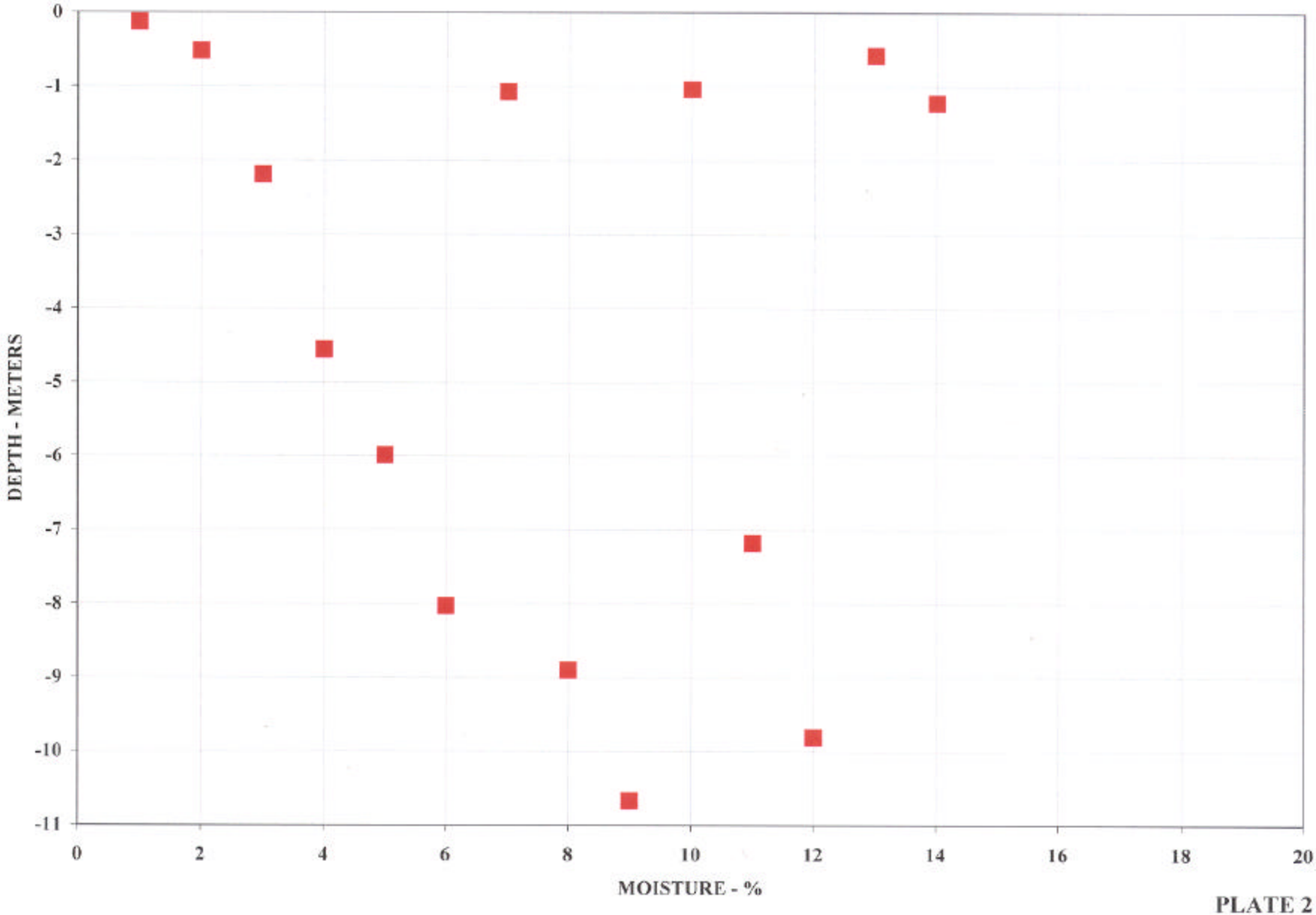

PLATE 2

TACTICAL EQUIPMENT SHOP
ATTERBERG LIMITS VS DEPTH

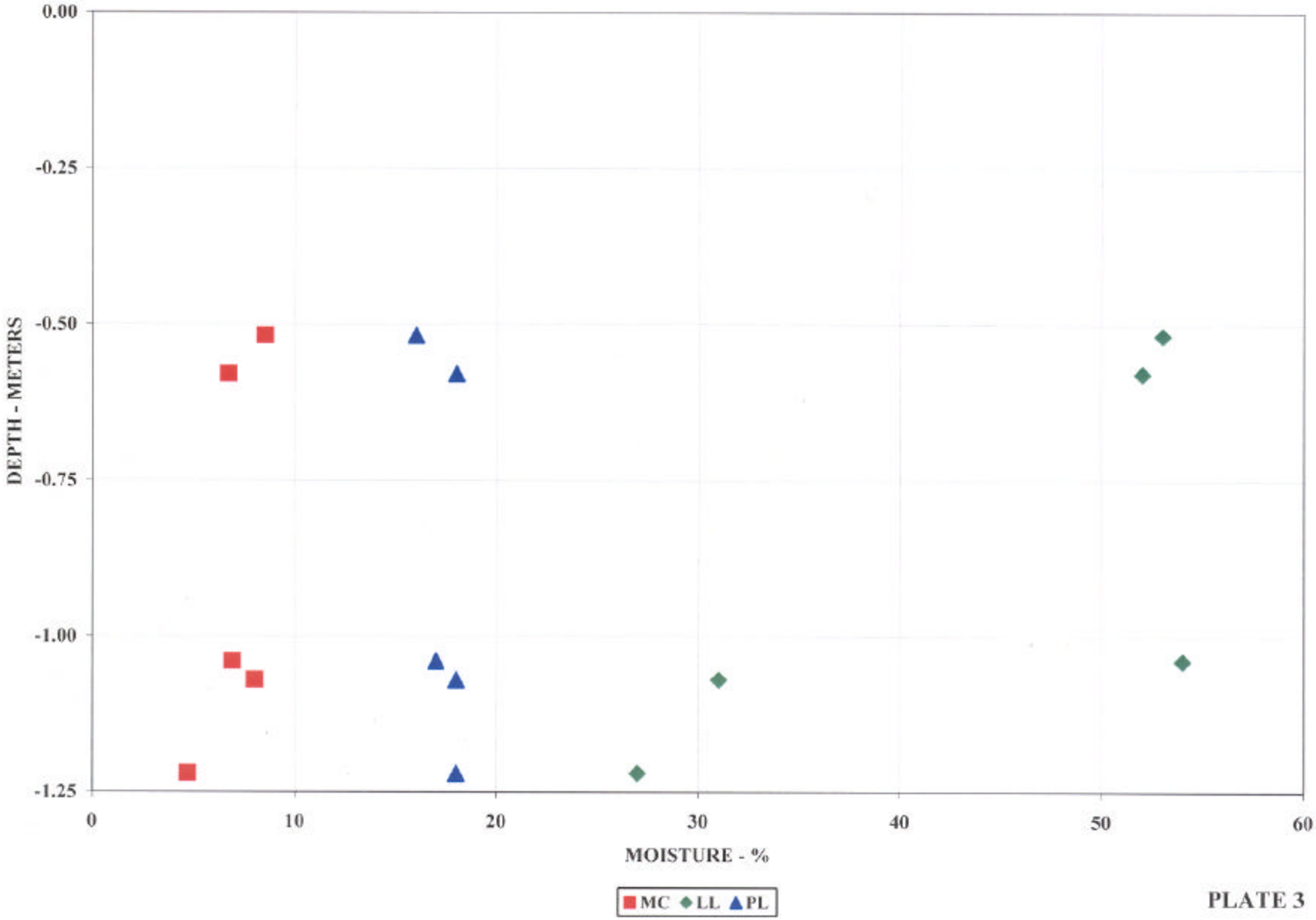

PLATE 3

TACTICAL EQUIPMENT SHOP
MOISTURE CONTENT-DRY DENSITY VS DEPTH

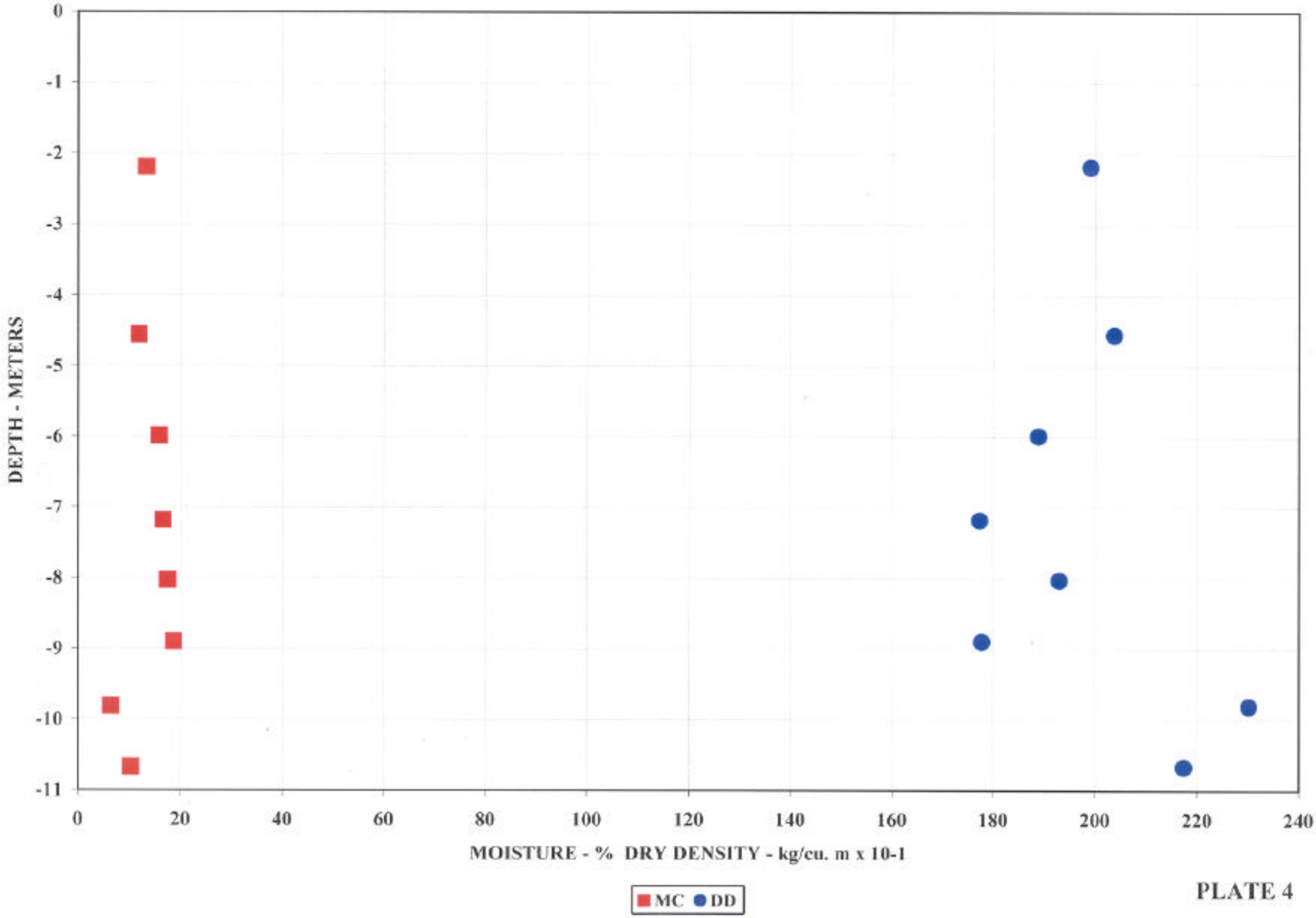

PLATE 4

APPENDIX C

SUMMARY OF LABORATORY TEST RESULTS

LABORATORY TESTING SERVICES
TACTICAL EQUIPMENT SHOP
FORT HOOD, TEXAS

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Percent Passing Sieve #4	#10	#20	#40	#60	#80	#100	#200
8A4C-5379	JAR A *	0.0 - 0.9	Brown Silty Sand w/numerous calcareous nodules & limestone fragments	SM	60.9	51.5	44.7	39.6	36.1	33.5	32.2	28.4
	JAR B	0.9 - 2.5	Tan & Gray Clay w/sand	CH	-----	-----	-----	-----	-----	-----	-----	-----
	C - 1	6.8 - 7.6	Tan Fossiliferous Limestone w/clay seams	N/A	-----	-----	-----	-----	-----	-----	-----	-----
	C - 2	14.5 - 15.4	Tan Clay, Slickensided w/limestone seams	CH	-----	-----	-----	-----	-----	-----	-----	-----
	C - 3	19.2 - 20.1	Tan Clay, Slickensided w/limestone seams	CH	-----	-----	-----	-----	-----	-----	-----	-----
	C - 4	26.0 - 26.7	Dark Gray Shale w/limestone fragments	N/A	-----	-----	-----	-----	-----	-----	-----	-----
8A4C-5380	JAR A	1.5 - 2.0	**NO TESTS**	-----	-----	-----	-----	-----	-----	-----	-----	-----
	JAR B	2.0 - 5.0	Tan Calcareous Clay	CL	92.8	90.6	89.1	87.5	86.1	85.1	84.6	82.8
	C - 1	28.7 - 29.7	Tan Clay, Slickensided w/limestone seams	CH	-----	-----	-----	-----	-----	-----	-----	-----
	C - 2	34.5 - 35.5	Dark Gray Shale w/fossiliferous limestone seams	N/A	-----	-----	-----	-----	-----	-----	-----	-----
8A4C-5382	JAR A	0.8 - 6.0	Tan Clay w/calcareous nodules	CH	97.1	94.5	93.1	92.3	91.7	91.2	91.0	89.2
	C - 1	23.1 - 24.0	Tan Clay, Slickensided w/limestone seams	CH	-----	-----	-----	-----	-----	-----	-----	-----
	C - 2	31.8 - 32.6	Tan Fossiliferous Limestone	N/A	-----	-----	-----	-----	-----	-----	-----	-----
8A4C-5383	JAR A	0.8 - 3.0	Dark Brown Clay w/sand & occasional gravel	CH	94.8	87.8	82.5	78.8	76.3	74.6	73.9	71.1
	JAR B	3.0 - 5.0	Tan Calcareous Clay	CL	97.2	94.0	91.3	88.9	86.9	85.8	85.4	83.9

*** Due to particle size in the samples delivered to the laboratory and the limited volume of the sample, the gradation analysis may not be representative of in-situ field conditions.**

SUMMARY OF LABORATORY TEST RESULTS

LABORATORY TESTING SERVICES
TACTICAL EQUIPMENT SHOP
FORT HOOD, TEXAS

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Moisture Content (%)	Unit Dry Weight (pcf)	Atterberg Limits LL	PL	PI	Remarks
8A4C-5379	JAR A	0.0 - 0.9	Brown Silty Sand w/numerous calcareous nodules & limestone fragments	SM	3.3	-----	Non-Plastic			-----
	JAR B	0.9 - 2.5	Tan & Gray Clay w/sand	CH	8.5	-----	53	16	37	-----
	C - 1	6.8 - 7.6	Tan Fossiliferous Limestone w/clay seams	N/A	13.3	124.3	-----	-----	-----	-----
	C - 2	14.5 - 15.4	Tan Clay, Slickensided w/limestone seams	CH	11.9	127.2	-----	-----	-----	-----
	C - 3	19.2 - 20.1	Tan Clay, Slickensided w/limestone seams	CH	15.9	117.9	-----	-----	-----	-----
	C - 4	26.0 - 26.7	Dark Gray Shale w/limestone fragments	N/A	17.5	120.5	-----	-----	-----	-----
8A4C-5380	JAR A	1.5 - 2.0	**NO TESTS**	-----	-----	-----	-----	-----	-----	-----
	JAR B	2.0 - 5.0	Tan Calcareous Clay	CL	8.0	-----	31	18	13	-----
	C - 1	28.7 - 29.7	Tan Clay, Slickensided w/limestone seams	CH	18.7	110.9	-----	-----	-----	-----
	C - 2	34.5 - 35.5	Dark Gray Shale w/fossiliferous limestone seams	N/A	10.3	135.7	-----	-----	-----	-----
8A4C-5382	JAR A	0.8 - 6.0	Tan Clay w/calcareous nodules	CH	6.9	-----	54	17	37	-----
	C - 1	23.1 - 24.0	Tan Clay, Slickensided w/limestone seams	CH	16.6	110.7	-----	-----	-----	-----
	C - 2	31.8 - 32.6	Tan Fossiliferous Limestone	N/A	6.4	143.7	-----	-----	-----	-----
8A4C-5383	JAR A	0.8 - 3.0	Dark Brown Clay w/sand & occasional gravel	CH	6.7	-----	52	18	34	-----
	JAR B	3.0 - 5.0	Tan Calcareous Clay	CL	4.7	-----	27	18	9	-----

SUMMARY OF LABORATORY TEST RESULTS

LABORATORY TESTING SERVICES
TACTICAL EQUIPMENT SHOP
FORT HOOD, TEXAS

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Moisture Content (%)	Unit Dry Weight (pcf)	Confining Pressure (tsf)	Q_u (tsf)	Strain @ Failure (%)	Type Failure
8A4C-5379	JAR A	0.0 - 0.9	Brown Silty Sand w/numerous calcareous nodules & limestone fragments	SM	3.3	-----	-----	-----	-----	-----
	JAR B	0.9 - 2.5	Tan & Gray Clay w/sand	CH	8.5	-----	-----	-----	-----	-----
	C - 1	6.8 - 7.6	Tan Fossiliferous Limestone w/clay seams	N/A	13.3	124.3	0	3.22	*	Hor. & Vertical
	C - 2	14.5 - 15.4	Tan Clay, Slickensided w/limestone seams	CH	11.9	127.2	-----	-----	-----	-----
	C - 3	19.2 - 20.1	Tan Clay, Slickensided w/limestone seams	CH	15.9	117.9	-----	-----	-----	-----
	C - 4	26.0 - 26.7	Dark Gray Shale w/limestone fragments	N/A	17.5	120.5	0	8.05	*	Vertical
8A4C-5380	JAR A	1.5 - 2.0	**NO TESTS**	-----	-----	-----	-----	-----	-----	-----
	JAR B	2.0 - 5.0	Tan Calcareous Clay	CL	8.0	-----	-----	-----	-----	-----
	C - 1	28.7 - 29.7	Tan Clay, Slickensided w/limestone seams	CH	18.7	110.9	0	1.12	1.0	Angular (45°)
	C - 2	34.5 - 35.5	Dark Gray Shale w/fossiliferous limestone seams	N/A	10.3	135.7	0	8.76	*	Hor. & Vertical
8A4C-5382	JAR A	0.8 - 6.0	Tan Clay w/calcareous nodules	CH	6.9	-----	-----	-----	-----	-----
	C - 1	23.1 - 24.0	Tan Clay, Slickensided w/limestone seams	CH	16.6	110.7	0	1.61	1.5	Angular (35°)
	C - 2	31.8 - 32.6	Tan Fossiliferous Limestone	N/A	6.4	143.7	0	23.24	*	Vertical
8A4C-5383	JAR A	0.8 - 3.0	Dark Brown Clay w/sand & occasional gravel	CH	6.7	-----	-----	-----	-----	-----
	JAR B	3.0 - 5.0	Tan Calcareous Clay	CL	4.7	-----	-----	-----	-----	-----

*** Strain measurements were not recorded for this test. This sample was an intact core of rock which was sawed square, ends capped with hydrostone high strength gypsum, and tested for compressive strength in accordance with ASTM D-2938 "Unconfined Compressive Strength of Intact Rock Core Specimens".**